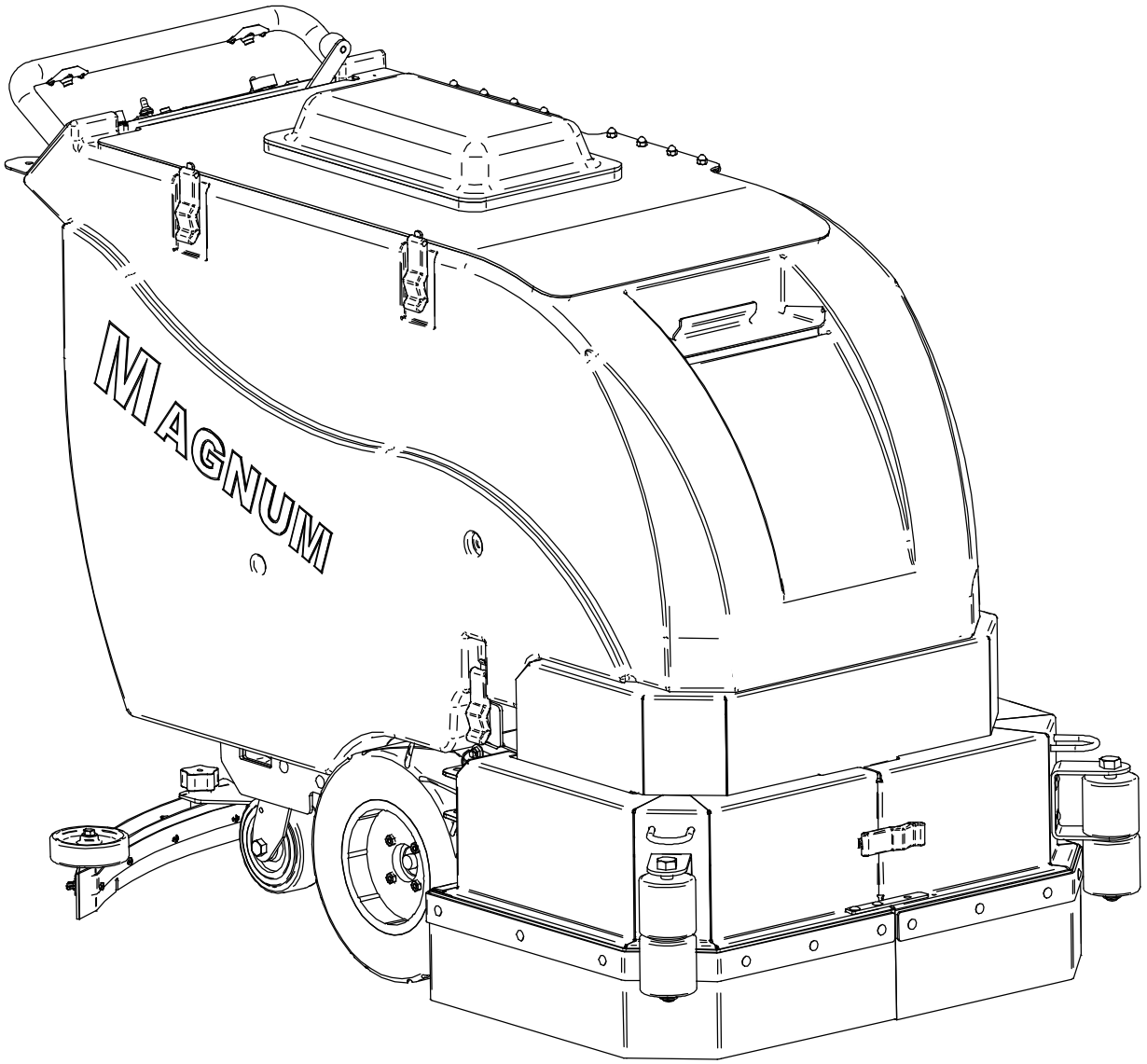
Version 1.0

SERVICE MANUAL

MAGNUM SERIES



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CAUTION!

To reduce the chance of personal injury and/or property damage, the following instructions must be careful observed:

Proper service and repair are important to the safety of the service technician and the safe reliable operation of all cleaning equipment. If part replacement is necessary, the part must be replaced with one of the same part number or with an equivalent part. Do not use replacement parts of lesser quality

The service procedures recommended and described in this service manual are effective methods of performing service and repair. Some of these procedures require the use of tools specifically designed for the purpose.

Accordingly anyone who intends to use a replacement part, service procedure or tool which is not recommended by the equipment manufacturer, must determine that neither his safety nor the safe operation of the equipment will be jeopardized by the replacement part, service procedure or tool selected.

It is important to note that this manual contains various cautions and notices that must be carefully observed in order to reduce the risk of personal injury during service or repair, or the possibility that improper service or repair may damage the piece of equipment or render it unsafe. It is also important to note that these 'Cautions' and 'Notices' are not exhaustive, because it is impossible to warn of all the possible hazardous consequences that might result from failure to follow these instructions.

FOREWORD

Factory Cat/Tomcat service manuals are intended for use by professional, qualified technicians. Attempting repairs or service without the appropriate training, tools, and equipment could cause injury to you or others and damage to your piece of equipment that may cause it not to operate properly

This manual should be kept in a convenient place for easy reference. When properly used, it will meet the needs of technicians and equipment owners.

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As our policy is one of constant improvement, all specifications are subject to change without notice.

SAFETY MESSAGE

Your safety and the safety of others is very important and operating this unit safely is an important responsibility.

To help you make informed decisions about safety, we have provided operation procedures and other safety information in this manual. This information informs you of potential hazards that could hurt you or others.

It is not practical or possible to warn you of all the hazards associated with operating this unit. You must use your own good judgement.

This machine is intended for commercial use. It is designed to be used on hard floors only and in an indoor environment, with the recommended pads and brushes with approved cleaning solutions.

DO NOT OPERATE THE UNIT:

- UNLESS TRAINED AND AUTHORIZED.
- UNLESS OPERATOR MANUAL IS READ AND UNDERSTOOD.
- IF UNIT IS NOT IN PROPER OPERATING CONDITION.

WHEN OPERATING UNIT:

- WEAR PROPER PROTECTIVE EQUIPMENT.
- REMOVE LOOSE OBJECTS FROM THE FLOOR THAT MAY BE PROJECTED FROM THE REVOLVING BRUSHES.
- DO NOT OPERATE THE MACHINE WHERE FLAMMABLE LIQUIDS OR GASES ARE PRESENT.
- USE EXTREME CAUTION WHEN MANEUVERING.
- MAKE SURE ALL PERSONS ARE A SAFE DISTANCE FROM THE MACHINE WHILE IN OPERATION.

BEFORE LEAVING THE UNIT:

- PARK MACHINE ON A LEVEL SURFACE.
- MAKE SURE MACHINE IS TURNED OFF.
- DISCONNECT BATTERIES.

BEFORE SERVICING:

- STOP ON A LEVEL SURFACE AND SECURE MACHINE.
- DISCONNECT BATTERIES.

SAFETY PRECAUTIONS

- Hazardous voltage. Shock, Burns or electrocution can result. ALWAYS disconnect the batteries before servicing machine.
- Batteries emit hydrogen gases, explosion or fire can result. Keep sparks and open flame away!
- Charge unit in a well ventilated area and keep battery compartment open when charging or explosion or fire could result.
- Battery acid can cause burns. Wear protective face-shield and gloves when servicing batteries.
- Do not store outdoors or pressure wash. Prevent from getting electrical components wet.
- The use of parts and solutions other than recommended by the manufacturer may cause property damage, bodily injury or death to yourself or others.
- Dress safely. Do not wear rings, watches or other jewelry while working on this machine. They can cause an electrical short which can cause serious burns, other injury or death.
- Do not work on this machine while wearing a tie, scarf, hat or any other loose or dangling neck wear or clothing. Loose clothing can tangle or catch on rotating parts causing serious injury or death.
- Do not use this machine as a ladder or a chair.
- Operate this machine only from the operators position.
- This machine was not designed to carry passengers or transport cargo.
- Do not operate this machine on steep ramps or uneven surfaces. When climbing a ramp always drive the machine forward straight up or down the ramp. Never drive across the incline.
- Do not back down or turn on ramps!
- Always use the charger provided by the manufacturer to charge the machine. It is an automatic charger specifically designed to charge at the appropriate rate. If you must use a different charger, disconnect the batteries from the machine as this will protect the on-board electronics.
- Understand the dynamic breaking system before you operate the machine on ramps or slopes.
- Do not park the machine on ramps or slopes
- Do not operate the machine if any parts have been removed or damaged.
- Do not remove, paint over, or destroy warning decals. If warning decals become damaged they must be replaced.
- Do not operate machine in an unsafe condition. If the machine is need of repair or is in anyway unsafe to operate, the matter should be reported immediately to the shift supervisor. Do not operate the machine until it is returned to proper operating condition.
- This machine must be operated only by a trained operator. As part of their training they must read the operators manual thoroughly. If extra copies are needed contact your local dealer.
- Always park machine on a level surface and turn the power off before leaving it unattended.
- Do not operate over electrical floor outlets. This may result in serious injury or death to the operator and others.
- Do not work under machine without it properly supported on suitable safety stands.
- Do not try and lift this machine unaided it is very heavy.
- Do not use handle bars or steering mechanism as a lifting point

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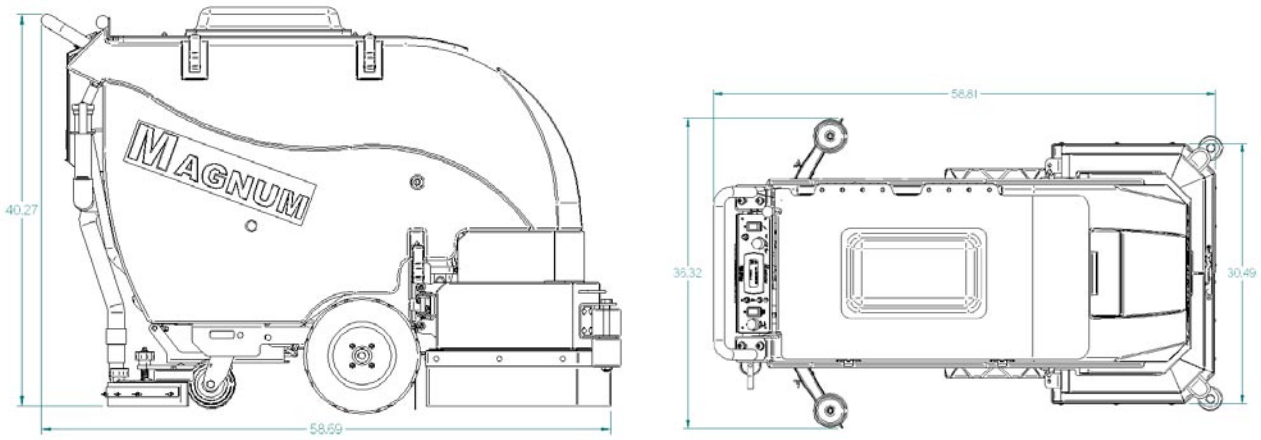
SPECIFICATIONS



Machine Length	58 3/4 in.	(149cm)
Machine Height	40 1/4 in.	(102cm)
Machine Chassis Width	24.1/2 in.	(62 cm)
Machine Current Consumption (Average)	55 Amps	Brush Motor: Up to 70 Amps Vacuum Motor: Up to 30 Amps Transport Drive: Up to 70 Amps
Solution Tank Capacity	30 Gallons	(114 liters)
Recovery Tank Capacity	30 Gallons	(114 liters)
Solution Flow Rate	0 - 2 GPM	(0 - 7.56 liters/min)
Operating Noise Level (at operator)	70 dB(A)	
Forward Scrub Speed	0 - 300 ft.min (4 1/2) mph	(0- 92 meters / min (7.5 kph))
Vacuum Motor (3 Stage)	.75 hp (660 watt)	
Water lift	68”	
Airflow	72 cfm	
Power Source (Batteries)		
Standard	(2) 12 Volt / 185 amp hour capacity	
Weight (Each)	66 lbs. (30 kg)	
Mid Capacity	(4) 6 Volt / 245 amp hour capacity	
Weight (Each)	122 lbs. (56kg)	
High Capacity	(4) 6 Volt / 325 amp hour capacity	
Weight (Each)	122 lbs. (56kg)	
Battery Compartment Size		
Height	13 in.	(33 cm)
Width	14 in.	(35.5 cm)
Length	17 in.	(43 cm)
Estimated Battery Run Time	Up to 5 hours.	
Battery Charger	24 Volt / 18 amp	

SPECIFICATIONS

	Magnum-26C	Magnum-26D	Magnum-30C	Magnum-30D	Magnum-34C	Magnum-34D
Machine Width with Squeegee	32 3/4 in. 83 cm	32 3/4 in. 83 cm	36 3/4 in. 93 cm	36 3/4 in. 93 cm	43 3/4 in. 111 cm	43 3/4 in. 111 cm
Scrub Brush Size (qty. 2)	22 x 5.5 in. 56 x 14 cm	13 in. 56 cm	28 x 5.5 in. 59 x 14 cm	15 in. 59 cm	32 in. x 5.5 in. 81 x14 cm	17 in. 81 cm
Scrub Brush Motor (qty. 2) (standard) (HD)	.75 hp n/a	.75 hp 1.0 hp	.75 hp n/a	.75 hp 1.0 hp	.75 hp n/a	.75 hp 1.0 hp
Scrub Brush Speed	750 rpm	270 rpm	750 rpm	270 rpm	750 rpm	270 rpm
Machine Net Weight *	489 lbs. 222 kg.	489 lbs. 222 kg.	491 lbs. 223 kg.	491 lbs. 223 kg.	494 lbs. 224 kg.	494 lbs. 224 kg.
Machine Gross Weight **	967 lbs. 438 kg.	967 lbs. 438 kg.	971 lbs. 440 kg.	971 lbs. 440 kg.	974 lbs. 442 kg.	974 lbs. 442 kg.
Cleaning Width	24 in. 61 cm	26 in. 66 cm	27 in. 69 cm	30 in. 76 cm	30 in. 77 cm	34in. 87 cm
Cleaning Rate Per Hour	26,000 sq. ft./hr 2415 sq. meters./hr	26,000 sq. ft./hr 2415 sq. meters./hr	30,000 sq. ft./hr 2787 sq. meters./hr.	30,000 sq. ft./hr 2787 sq. meters./hr.	34,000 sq. ft./hr 3159 sq. meters./hr.	34,000 sq. ft./hr 3159 sq. meters./hr.

* NET WEIGHT: Standard equipped machine with no options installed. Empty recovery and solution tanks and no batteries, pad holder or scrub brush.

** GROSS WEIGHT: Standard equipped machine with no options installed. Full solution and empty recovery tank. Standard pad holder or scrub brush and standard batteries.

MAINTENANCE

MAINTENANCE SCHEDULE

MAINTENANCE SCHEDULE	DAILY	WEEKLY	MONTHLY	EVERY 200 HRS
Charge the batteries	X			
Inspect pad or brush condition	X			
Drain and clean out tanks and hoses	X			
Clean float screen & drain saver in recovery tank	X			
Remove and clean squeegee tool. Inspect for wear or damage.	X			
Wipe down outside of machine	X			
Check battery electrolyte level in all cells		X		
Check all skirts and wipers on machine		X		
Check batteries and terminals for irregularities		X		
Lubricate machine			X	
Check carbon brushes on motors				X
Blow out dust from motors			X	

ATTENTION!

Make sure machine is turned off and the batteries are disconnected before performing any repairs or service on the machine!

Your machine is equipped with four brush-type motors that require periodic inspection to assess wear. Failure to inspect on regular intervals can result in motor damage that is not covered under warranty.

LUBRICATION

The machine requires periodic lubrication on each grease fitting on the machine and oiling of some pivot points and threads. Once a month is generally acceptable unless the machine is used in a severe duty application.

The grease fittings are located on:
Rear casters

The following points to be oiled lightly are:
Squeegee knob threads
Squeegee adjustment threads
Squeegee pivot points
Brush head pivot points

MAGNUM Series

PREVENTIVE MAINTENANCE WORKSHEET

CUSTOMER INFORMATION		
CUSTOMER		
ADDRESS		
CITY	STATE	ZIP CODE

MACHINE INFORMATION	
MODEL #	SERIAL #
WORK ORDER#	HOUR METER:

BATTERY CONDITION	Cell #1	Cell #2	Cell #3	Cell #4	Cell #5	Cell #6
Battery # 1 Hydrometer						
Battery # 1 Water Condition						
Battery # 2 Hydrometer						
Battery # 2 Water condition						
Battery # 3 Hydrometer						
Battery # 3 Water Condition						
Battery # 4 Hydrometer						
Battery # 4 Water condition						

Clean Battery Tops. Check Battery Cable and Terminal Condition
NOTES:

BRUSH CONDITION				
Scrub Brush Fiber Length			Rotated Brushes	
Brush Drive Sockets		Good	Worn	Needs Replacement
Drive Hubs		Good	Worn	Needs Replacement

CHECK OPERATION AND CONDITION OF:	IN SPEC	REPAIR	PROBLEM
Main Power Switch or Key Switch			
Handle Bar Switches			
Speed Potentiometer			
Reverse Switch			
LCD Display			
Page Switch			
Brush Pressure Switch			
Brush Pressure Managers Lock Out			
Reverse Switch			
Brush Switch			
Brush Deck Lift System			
Brush Motor			
Brush Drive Chain & Grease (Cylindrical Only)			
Solution Potentiometer			
Solution Solenoid			
Vacuum Switch			
Vacuum Motor Performance			
Vacuum Filter			
Recovery Drain Hose & Plug			
Squeegee Lift System			
Squeegee Adjustment			

MAGNUM Series

PREVENTIVE MAINTENANCE WORKSHEET

CHECK OPERATION AND CONDITION OF:	IN SPEC	REPAIR	PROBLEM
Spray Jet Switch			
Spray Jet Pump, Hose & Nozzle			
Battery Charger Connectors			
Battery Charger			

CLEAN AND/OR LUBRICATE	IN SPEC	REPAIR	PROBLEM
Solution Filter			
Squeegee Pivot Points & Knobs			
Scrub Deck Linkage			
Caster grease fittings			
Squeegee Knob Threads			
Squeegee Pivot Points			
Brush Head Pivot Points			

VISUALLY INSPECT:	IN SPEC	REPAIR	PROBLEM
Solution Tank Condition			
Recovery Tank & Lid Condition			
Drain Saver			
Vacuum Float			
Vacuum Motor Brushes			
Vacuum Hoses			
Vacuum Filter			
Solution Hoses			
Squeegee Tool and Throat			
Squeegee Blades			
Blade retainers & Hardware			
Squeegee Wheels			
Brush Skirts			
Brush Motor Brushes			
Brush or Pad Driver Condition			
Drive Wheel Condition			
Caster Condition			

COMMENTS

Technician's Name _____

Technician's Signature _____ Date _____

Customer's Name: _____

Customer's Signature _____ Date _____

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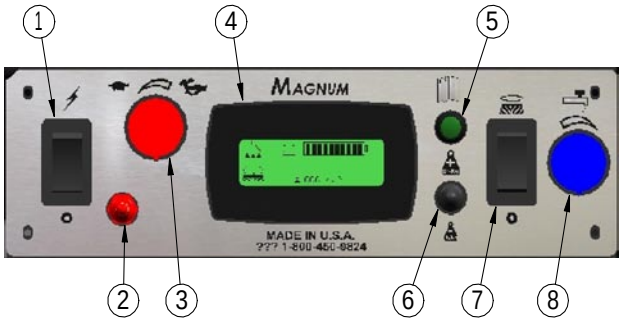
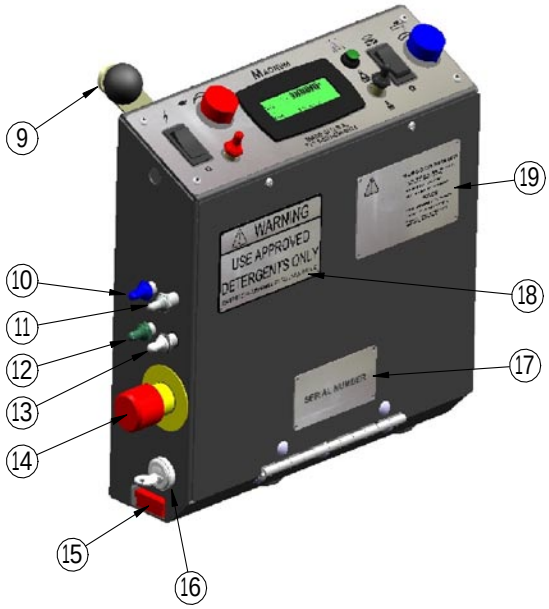
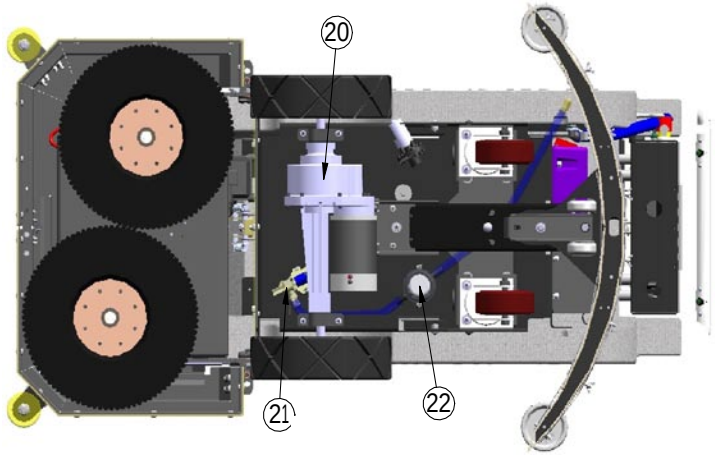
MACHINE PARTS



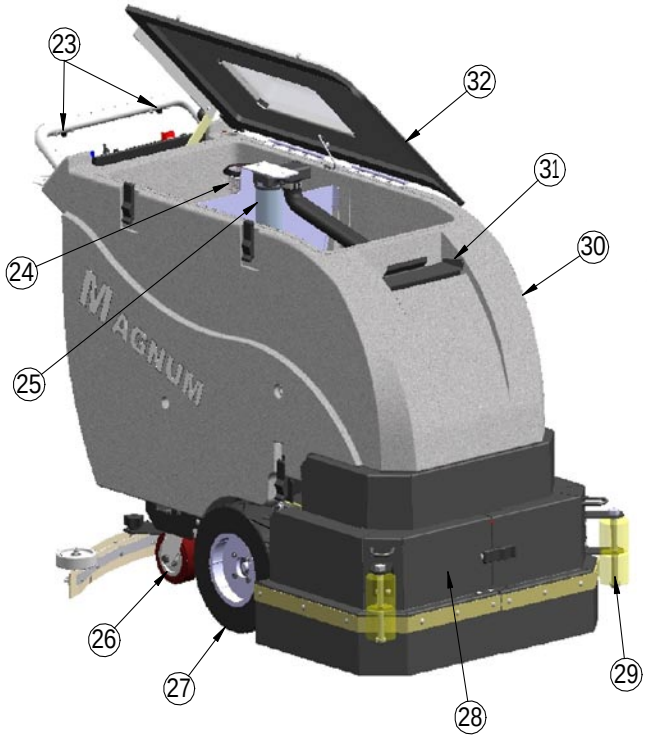
1. MAIN POWER SWITCH
2. FORWARD/REVERSE SWITCH (RED)
3. SPEED CONTROL KNOB
4. LCD SCREEN
5. MENU CONTROL
6. SCRUB DECK DOWN PRESSURE SWITCH
7. SCRUB DECK SWITCH
8. SOLUTION FLOW CONTROL KNOB



9. SQUEEGEE LIFT LEVER
10. SPRAY JET (BLUE) (OPTIONAL)
11. ELECTRIC SQUEEGEE LIFT (GREY) (OPTIONAL)
12. RECYCLING SWITCH (GREEN) (OPTIONAL)
13. “ON BOARD” SOAP SYSTEM (WHITE) (OPTIONAL)
14. EMERGENCY STOP (OPTIONAL)
15. CHARGER PORT
16. KEY SWITCH (OPTIONAL)
17. SERIAL NUMBER PLATE: Machine identification
18. WARNING PLATE
19. WARNING PLATE
20. TRACTION DRIVE
21. SOLUTION FLOW VALVE
22. SOLUTION FILTER

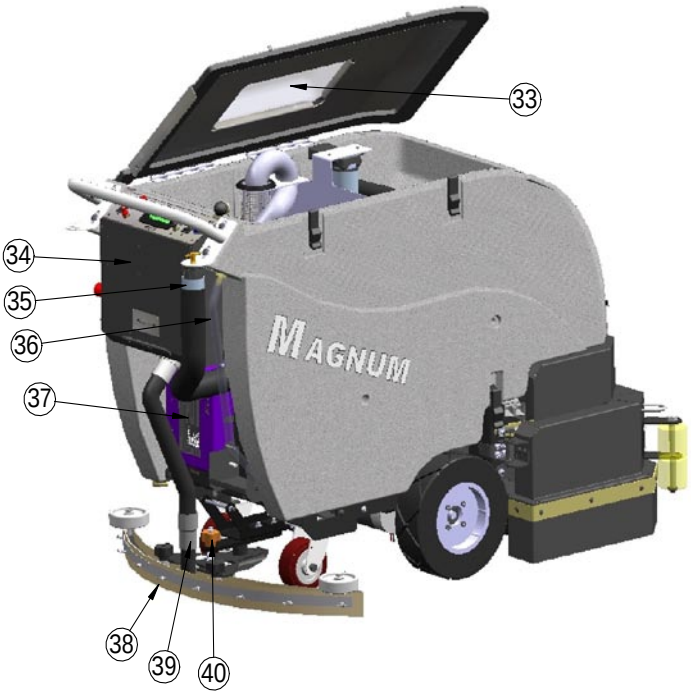


20. TRACTION DRIVE
21. SOLUTION FLOW VALVE
22. SOLUTION FILTER



20. TRACTION DRIVE
21. SOLUTION FLOW VALVE
22. SOLUTION FILTER
23. DRIVE BUTTON
24. “DRAIN SAVER” STRAINER
25. VAC SCREEN
26. CASTER
27. MAIN TIRES
28. JAWS
29. POLYURETHANE ROLLERS
30. TANK-IN-TANK
31. SOLUTION FILL LID
32. RECOVERY LID

33. CLEAR COVER
34. CONTROL PANEL
35. RECOVERY DRAIN HOSE
36. SOLUTION LEVEL INDICATOR & DRAIN
37. “ON BOARD” BATTERY CHARGER
38. SQUEEGEE BLADE
39. VACUUM HOSE
40. SQUEEGEE PITCH ADJUSTMENT



CONTROL DESCRIPTION

1. MAIN POWER SWITCH: Turns the machine on and off.
2. FORWARD/REVERSE SWITCH (RED): Makes the machine move backwards when depressed.
3. SPEED CONTROL KNOB: Controls the speed of the Traction Drive.
4. LCD SCREEN: Lists status, functions and settings of the machine.
5. MENU CONTROL: Scrolls through different options on the LCD Display
6. SCRUB DECK DOWN PRESSURE SWITCH: Controls the pressure put on the Scrub deck
7. SCRUB DECK SWITCH: Raises and lowers the Scrub deck
8. SOLUTION FLOW CONTROL KNOB: Turn clockwise to reduce & outer clockwise to increase flow.
9. SQUEEGEE LIFT LEVER: Raises and lowers Squeegee
10. SPRAY JET (BLUE) (OPTIONAL): Activates Spray Pump for remote Spray Wand
11. ELECTRIC SQUEEGEE LIFT (GREY) (OPTIONAL): Electronically raises and lowers Squeegee.
12. RECYCLING SWITCH (GREEN) (OPTIONAL): Turns on the Recycling Pump
13. “ON BOARD” SOAP SYSTEM (WHITE) (OPTIONAL): Dispenses soap into Solution Tank
14. EMERGENCY STOP (OPTIONAL): Shuts off power to the machine
15. CHARGER PORT: Port for plugging an external charger into the machine. (Use only the charger supplied with the machine.)
16. KEY SWITCH (OPTIONAL): Turns power on to the machine. Prevents unauthorized operation.
17. SERIAL NUMBER PLATE: Machine identification
18. WARNING PLATE: Detergent/Water warning.
19. WARNING PLATE: Explosion warning
20. TRACTION DRIVE: Propels machine forward/backward
21. SOLUTION FLOW VALVE: Controls solution flow rate, when solution switch is on
22. SOLUTION FILTER: Filters water solution prior to scrubbing.
23. DRIVE BUTTON: Depress to drive forward, release to stop. (starts & stops the scrub motor)
24. “DRAIN SAVER” STRAINER: Helps prevent clogging of drain hose.
25. VAC SCREEN: Protects Vac Motor from debris.
26. CASTER: Twin casters for stability
27. MAIN TIRES: Non-Marking tires
28. JAWS: Protects Scrub deck from collision damage
29. POLYURETHANE ROLLERS: Helps protect machine when scrubbing near walls.
30. TANK-IN-TANK: Solution/Recovery Tank (30 gallon capacity each).
31. SOLUTION FILL LID: Fill port for filling Solution Tank
32. RECOVERY LID: Allows unfettered access to the Recovery Tank allowing it to be completely cleaned with fresh water.
33. CLEAR COVER: For observing Recovery Tank status while operating machine.
34. CONTROL PANEL: Houses machine controls.
35. RECOVERY DRAIN HOSE: Allows for controlled draining of Recovery Tank.
36. SOLUTION LEVEL INDICATOR & DRAIN TUBE: Shows precise level of cleaning solution in Tank & serves as a Drain Port.
37. “ON BOARD” BATTERY CHARGER: Recharges batteries.
38. SQUEEGEE BLADE: Recovers dirty water from the floor to be recovered by the Vacuum Hose.
39. VACUUM HOSE: Squeegee. NOTE: Keep free and clear of blockage.
40. SQUEEGEE PITCH ADJUSTMENT: Adjusts pitch of Squeegee. Deflection should be even across the entire blade.

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SQUEEGEE SYSTEM

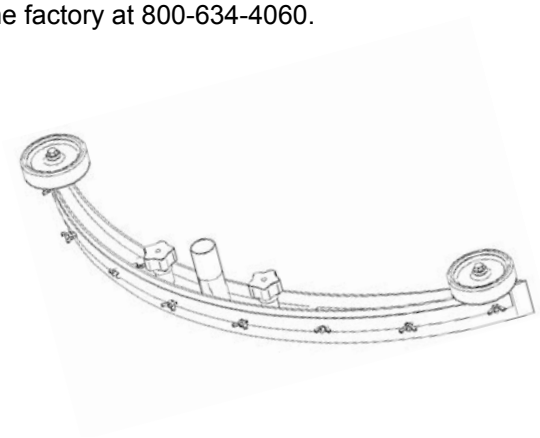
The Magnum's squeegee system is designed to work with the recovery system to pick up water and dirt from the floor using air flow created by the vacuum motor. The front blade of the squeegee tool is designed with notches that allow the air ,water and dirt to pass through it while metering the air, increasing its speed through the tool and recovery system.

The optimal performance of a squeegee is very dependent on proper adjustment and maintenance. The machines recovery system also must be operating properly for the squeegee to perform well.

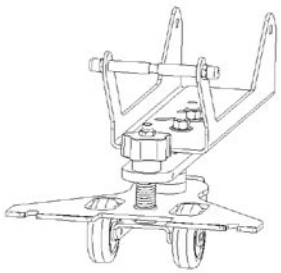
A vacuum gauge is a handy tool for checking recovery system operation. You should be able to achieve 65" of water lift on most models. Put the vacuum gauge in the end of the squeegee hose to check. If you have questions on this tool setup call the factory at 800-634-4060.

SQUEEGEE SYSTEM COMPONENTS

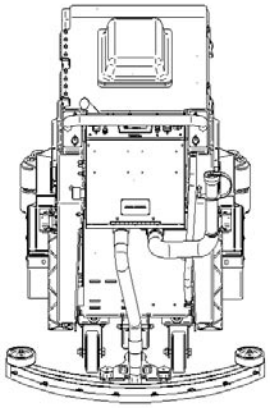
The squeegee tool with replaceable rollers & blades.



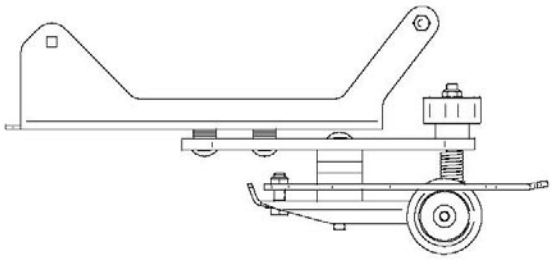
A suspension that mounts the squeegee to the machine, and allows the squeegee to move up and down with variations in the floor, and pivot in turns.



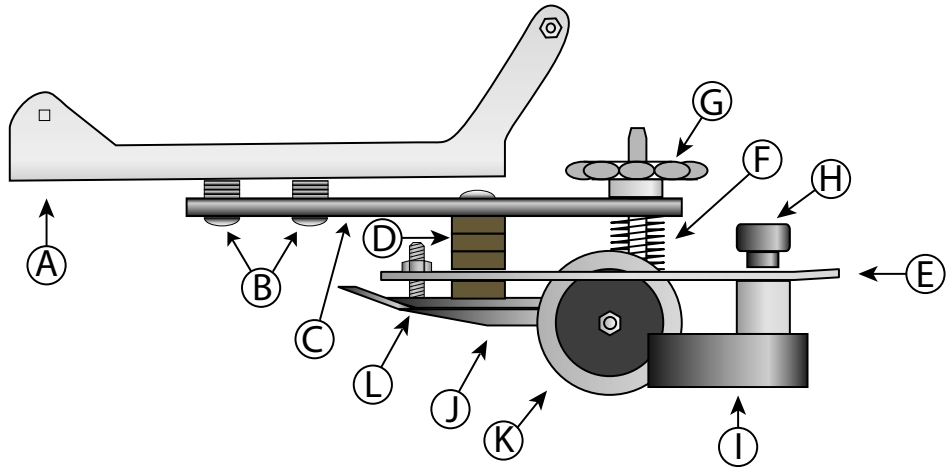
A lift system that allows the operator to raise the squeegee off the floor. The machine has a manual lift lever standard but an electric lift option is available.



A pitch adjustment that allows the operator to adjust the squeegee for different floor surfaces. This is used for creating more of a leak under the front blade for smooth floors or less of one for rough floors.



SQUEEGEE SUSPENSION BREAKDOWN

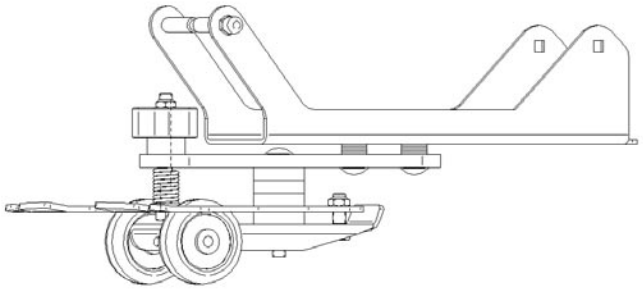


A. SQUEEGEE SWING PLATE – The swing plate is vulnerable to bending if the machine is driven over a curb or large bump. Always check this for straightness. If it is bent at all it must be replaced. Make sure the plate moves up and down easily at it's pivot points.
B. PIVOT BOLTS - These are the bolts that the squeegee pivots on. If they are too tight it will bind.
C. SQUEEGEE TRAIL ARM – This arm is made of ½" plate steel but is still possible to bend. If it is bent at all it must be replaced.
D. GROMMETS –These grommets maintain the proper spacing between the triangle plate and the Trail Arm.
E. SQUEEGEE TRIANGLE PLATE – The squeegee is mounted to the triangle plate and ties it to the trail arm.
F. SPRING – Supplies pressure between the triangle plate and the trail arm. Helps hold the adjustment. The squeegee will not operate without this spring.
G. PITCH ADJUSTMENT KNOB – The knob used to pitch the squeegee frontward or backwards. The squeegee should be adjusted to be flat to the floor.
H. SQUEEGEE HOLD DOWN KNOB – These knobs anchor the squeegee to the triangle plate. DO NOT OVER TIGHTEN!
I. SQUEEGEE BODY (SHOWN HERE WITHOUT BLADES) – The squeegee body is laser cut from ½" steel and must be perfectly straight and flat.
J. SQUEEGEE WHEEL MOUNT – The squeegee wheel mounts attach the wheels to the squeegee suspension. They can be adjusted by adjusting the bolt that controls their height.
K. SQUEEGEE WHEELS – The squeegee wheels should both touch the floor during operation and roll freely. They should both be adjusted to the same height. These wheels are wear items and should be replaced when squeegee blades are replaced.
L. SQUEEGEE WHEEL HEIGHT ADJUSTMENT SCREW. - This bolt controls the height of the squeegee wheels.

TRIANGLE PLATE & TOW BAR

These parts cannot be bent at all. They must be completely straight and flat. If either is bent replace it.

If you replace the triangle plate, adjust the clearance between the bottom of the plate and the top of the tow bar so clearance is 7/8" (22 mm). Squeegee will not work properly if this adjustment is off!



UP/DOWN MOVEMENT

The squeegee must be able to travel up and down freely so it can glide over bumps and uneven floors. It is hinged at the front as shown.

If the squeegee suspension does not move up and down properly check the bolts and the Oilite bushings at the pivot point. If the bolts are too tight (may have been tightened by customer by mistake) or the bushings are dried out or worn the squeegee will not be able to float properly.

SIDEWAYS MOVEMENT

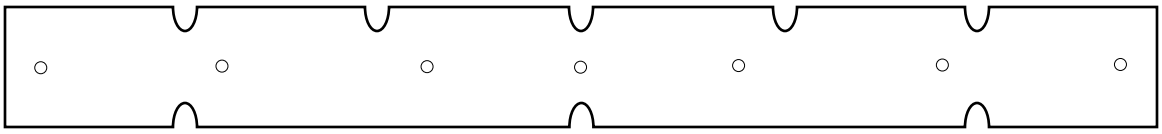
The squeegee must be allowed to move from side to side so that if it hits an obstacle it can move out of the way. If squeegee does not move freely from side to side check the bolt tension on the two pivot bolts. Check that the white plastic washers between the pivot plate and the trailing arm to make sure they are not damaged.

In order for the squeegee system to operate properly the parts have to be assembled properly. **The space between the bottom of the "Squeegee triangle plate" – E, and the "squeegee trail arm" – C, must be exactly 7/8" on all models but the 390, the 390 measurement is 1 3/8".** If this dimension is incorrect you will never get the squeegee blade adjusted properly. If you believe you are having problems with this adjustment, please call the factory: 800 634-4060.

SQUEEGEE BLADES

Squeegee blades are wear items. The back blade wears fastest on the edge that contacts the floor (lower front edge). This blade can ideally be turned four times. It is important to have a sharp squeegee edge on the floor; otherwise the squeegee does not scrape the water off the floor but instead glides right over it.

The front blade wears very well when properly adjusted, but it can get torn. It can be installed one of two ways: “3 notches down” for normal floors, and “5 notches down” for extremely smooth floors.

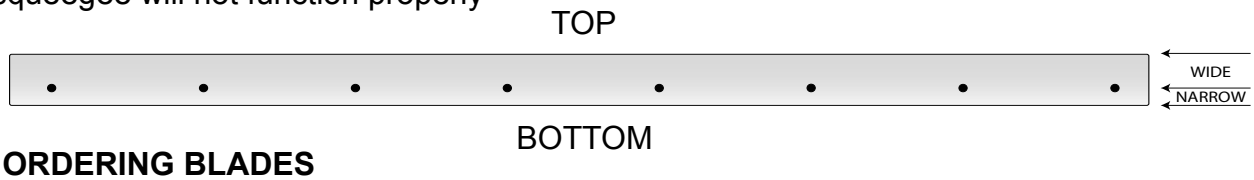


REPLACING BLADES

We stock individual blades or blade kits that include a blade set and new set of squeegee wheels. We recommend changing wheels when you change blades as they are wear items and they are critical to the proper operation of the squeegee.

When installing blades they must be put on without bumps or ripples. The squeegee should have a smooth edge that rides on the floor. When adjusting the blades you need to achieve a uniform “fanning” of the blade from one tip to the other. If the blade does not do this it is installed incorrectly or misadjusted.

When changing or turning squeegee blades it is very important to note the orientation of the stainless steel retaining band for re-installation. The holes are offset to make a wide side and narrow side. The wide side always goes UP. If the band is installed incorrectly the squeegee will not function properly



ORDERING BLADES

1. Find the squeegee size:
   Check the stamped number on the top of the squeegee body and order blades the corresponding blade size: (32, 35 ,38 or 45 inches).
2. Choose the appropriate material:
   Gum rubber - These blades are tan in color and best for most applications including irregular floors. They wear out quickly on rough floors however and do not tolerate oil, other petroleum products or heavy citrus cleaners. The kit number suffix for gum rubber is “G”. (Example 28-770-G)
   Linatex - These blades are red in color and designed to be very durable while at the same time giving optimum performance. They are very abrasion resistant and perform acceptably on irregular floors. They tolerate oil, petroleum products and heavy citrus cleaners better than gum rubber. The kit number suffix for Linatex is “L”.
   Polyurethane - These blades are nearly clear and are recommended for oil, petroleum or heavy citrus cleaner applications where Gum or Linatex would fail. It rarely works as efficiently as Gum or Linatex but is somewhat abrasion resistant. The kit number suffix for polyurethane is “U”.

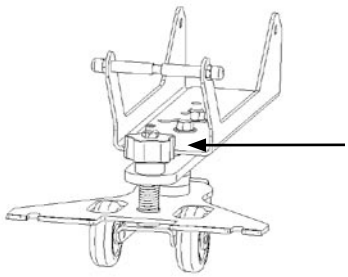
SQUEEGEE ADJUSTMENT

A squeegee needs to be adjusted to the type of surface that it is operating on. This means the adjustments that pick up well on rough concrete will probably not work well on glass-smooth vinyl tile or ceramic tile. The reverse would hold true also, a squeegee set up for a smooth surface will not work well on rough surfaces. As a squeegee wears, the dynamics or condition of the blades change, sometimes requiring small adjustments or sometimes requiring a blade turning or change.

Our squeegee system has only one operator-serviceable adjustment. That adjustment is the thumb wheel directly in front of the squeegee blade. By turning this knob you pivot the squeegee back and forth increasing or decreasing the amount of air allowed into the squeegee under the bottom of the front blade. The basic adjustment you are trying to achieve is to have the squeegee PERFECTLY parallel with the floor. From that point, rocking the squeegee forward about one half degree of pitch will reduce air leak. Rocking the squeegee backwards about one half degree will increase the air leak.

PITCH ADJUSTMENT KNOB

The triangular shaped plate that the squeegee bolts to is adjustable for a slight amount of up/down pitch. As you turn the knob the pitch of the squeegee changes.



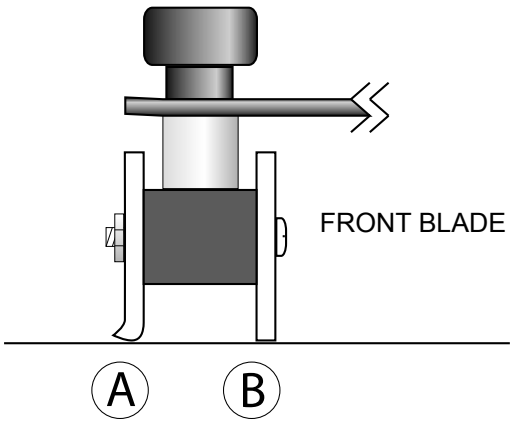
Turning the knob clockwise lowers the front blade of the squeegee thereby closing off the air holes against the floor. This increases suction on the floor. If you adjust it too far forward you can cause chattering problems or excessive front squeegee blade wear.

If too much suction is created the squeegee will “chatter”, and may come off the machine. If this happens the suction must be reduced by turning the knob counterclockwise 1 to 2 turns to create more of an air leak at the front blade.

You can over adjust in either direction. The squeegee will not work if the back blade is not evenly deflected across rear, and if wheels do not touch the floor.

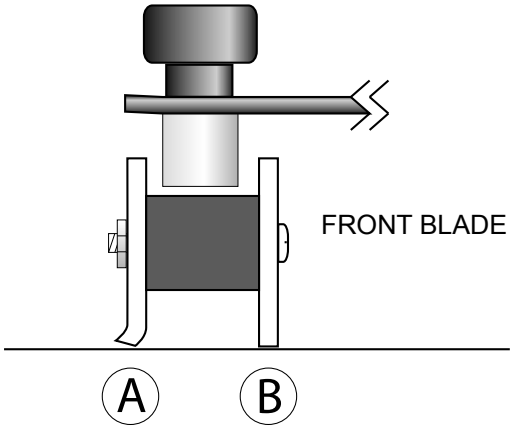
SQUEEGEE ADJUSTMENT EXAMPLES

FIGURE 1



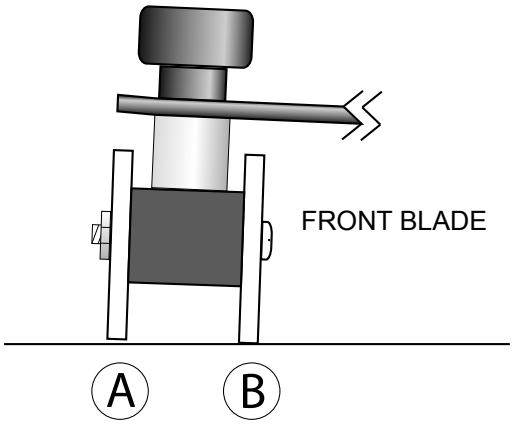
Worn Blade: Squeeegee wiping edge has worn so the square edge is gone. The squeegee now runs over the water instead of scraping it off the floor.

FIGURE 2



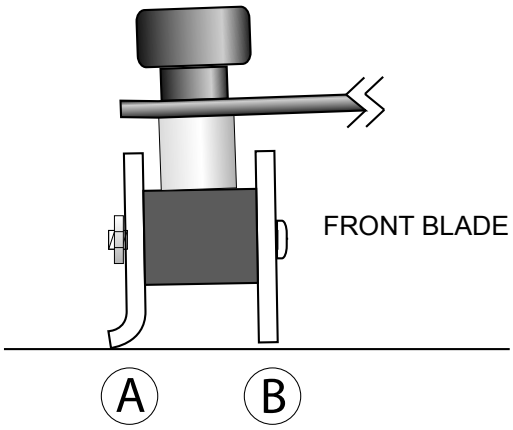
Properly Adjusted Squeegee: Front blade just contacts the floor rear blade is slightly flared outward

FIGURE 3



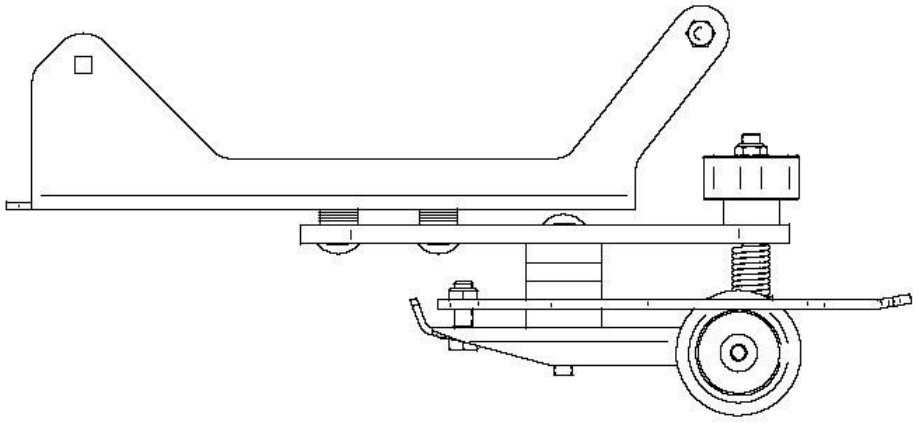
Too Much forward pitch on this squeegee. The Rear blade is barely making contact with the floor. The rear wheel are not touching the floor.

FIGURE 4



Too Much backward pitch on this squeegee. The rear blade is laying over and the front blade is not touching the floor.

The squeegee assemble has adjustable squeegee wheels. The adjustment for this is a 5/16 fine thread bolt and lock nut. It was designed this way to keep non-service personnel from adjusting it. The squeegee wheels wear with use and periodic adjustment of their height is required.



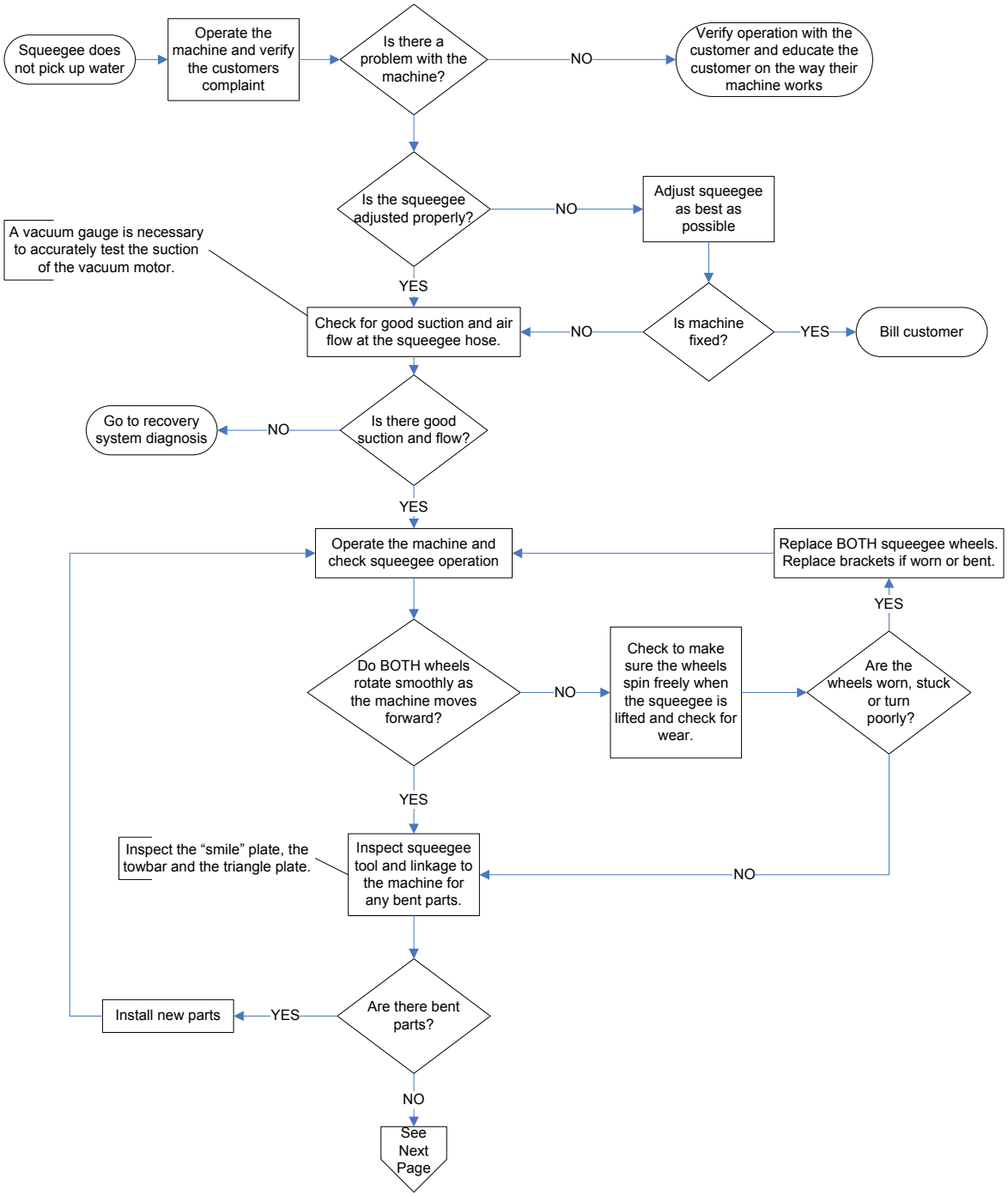
SQUEEGEE WHEEL ADJUSTMENT

First level the squeegee so the blade has an even roll to it on the back of the squeegee tool. Then adjust the wheels so the rear squeegee blade just rolls over when travelling forward.

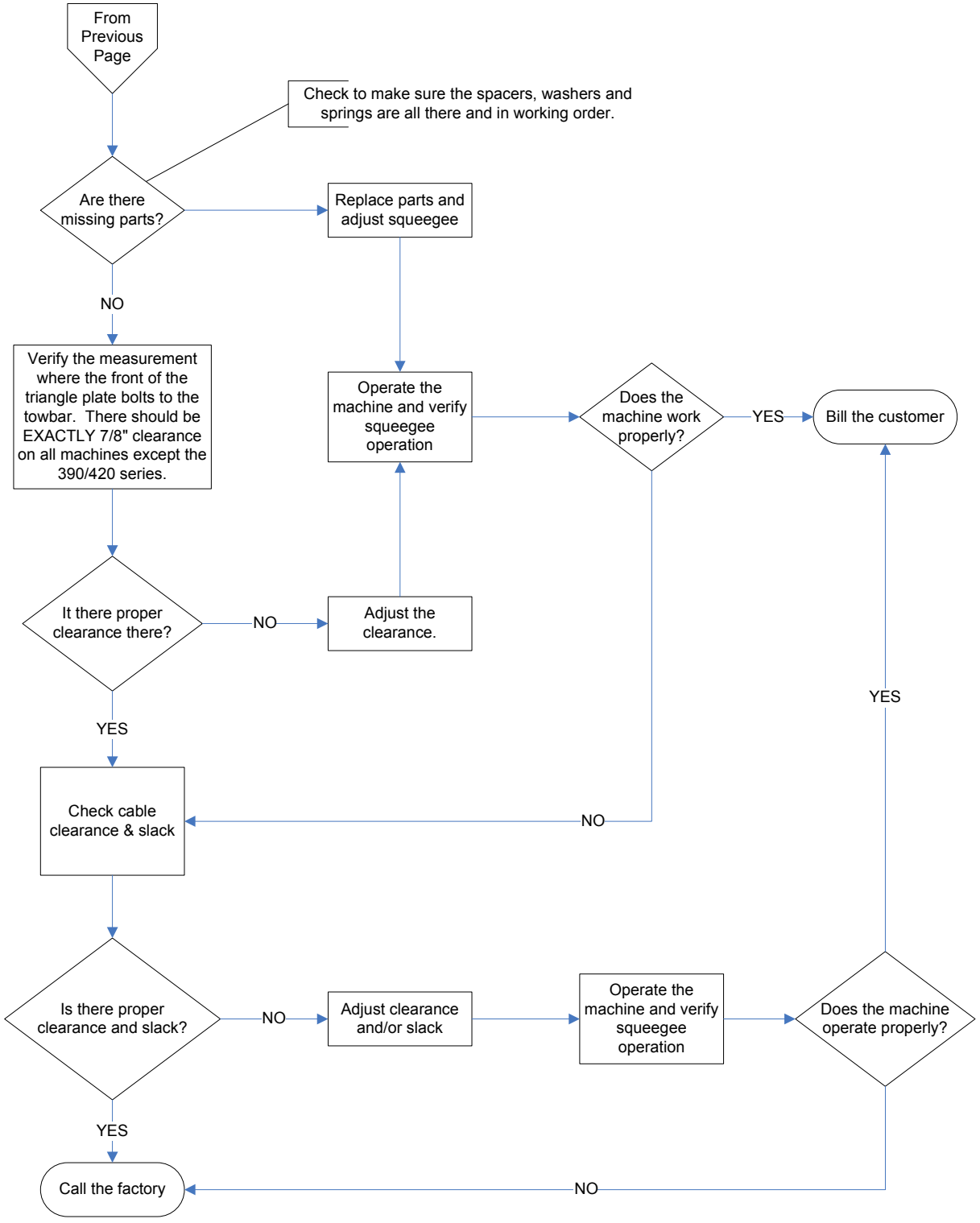
SQUEEGEE TROUBLESHOOTING

SQUEEGEE PROBLEM:	CAUSE / (SOLUTION)
Not picking up water	Is the squeegee or vac system clogged?
	Are the blades worn out?
	Is the machine straight from side to side? (No pitch or lean to either side because of tire problems?)
	Does machine have a slight pitch/lean backwards? (The unit should have about a 1-2 degree pitch/lean to the rear.)
	Is the squeegee or suspension bent or missing parts?
Leaving streaks	Dirt on blades. Wipe off with rags.
	Chip or tear in rear squeegee blade. (Turn blade or replace)
Sways back & forth	One or both wheels not touching floor. (Replace wheels and/or their brackets, shim as necessary.)
	Front or rear bolt missing or loose in triangle plate. Tighten or replace. Clearance between triangle and tow bar is 7/8".
Falls off frequently	Plastic knobs are loose. (Tighten)
	Operator hand strength is too low to tighten squeegee knobs adequately causing squeegee to fall off regularly. (Add a bevel washer <preferred> or a flat washer between each knob and the squeegee.
	Squeegee is creating too much suction on the floor. (This creates squeegee "chatter" Refer to squeegee adjustment section pg. 3-5)
	Triangle plate is bent where the squeegee attaches. (Replace)
Squeegee Leaves Water:	Squeegee is actually working properly but the operator has unreal expectations. (Educate the operator)
	Squeegee pitch out of adjustment (Adjust)
	Floor is extremely rough. (Use a solid front blade to control air better.)
	Back blade is worn out. (Rotate or replace blade)
	Squeegee tool is bent & leaking. (Replace tool)
	Squeegee suspension is bent. (Replace bent components)
	Operator sees water left on very hard turns. (Educate the operator on making more gradual turns or to shut off the water before entering a turn.)
Squeegee howls or trumpets	Squeegee is creating too much a suction on the floor. (Adjust squeegee to allow more air to enter from the front blade. Counter-clockwise adjustment.)
	Squeegee is creating too much a suction on the floor. (Reverse front blade so five notches face downward to allow more air flow)
Squeegee needs too much adjustment	Customer has a varied floor surface. Some of the floor is smooth other parts are very rough. (Frequent adjustment is normal and will be required.)
	Adjustment knob spring is missing , incorrect or damaged. (Replace)
Blades wear out very quickly	Floor is very rough. Switch to Linatex rubber (red blades) which is very resistant to abrasion.
	Floor is oily or a harsh cleaning chemical has made the blade deform. Change to polyurethane blades (clear blades), they resist chemical best

MAGNUM SQUEEGEE DIAGNOSTIC FLOW CHART
1 of 2


Squeegee does not pick up water
Operate the machine and verify the customers complaint
Is there a problem with the machine?
NO
Verify operation with the customer and educate the customer on the way their machine works
Is the squeegee adjusted properly?
NO
Adjust squeegee as best as possible
A vacuum gauge is necessary to accurately test the suction of the vacuum motor.
YES
Check for good suction and air flow at the squeegee hose.
NO
Is machine fixed?
YES
Bill customer
Go to recovery system diagnosis
NO
Is there good suction and flow?
YES
Operate the machine and check squeegee operation
Replace BOTH squeegee wheels. Replace brackets if worn or bent.
YES
Do BOTH wheels rotate smoothly as the machine moves forward?
NO
Check to make sure the wheels spin freely when the squeegee is lifted and check for wear.
Are the wheels worn, stuck or turn poorly?
YES
Inspect the “smile” plate, the towbar and the triangle plate.
Inspect squeegee tool and linkage to the machine for any bent parts.
NO
Install new parts
YES
Are there bent parts?
NO
See Next Page

MAGNUM SQUEEGEE DIAGNOSTIC FLOW CHART
2 of 2

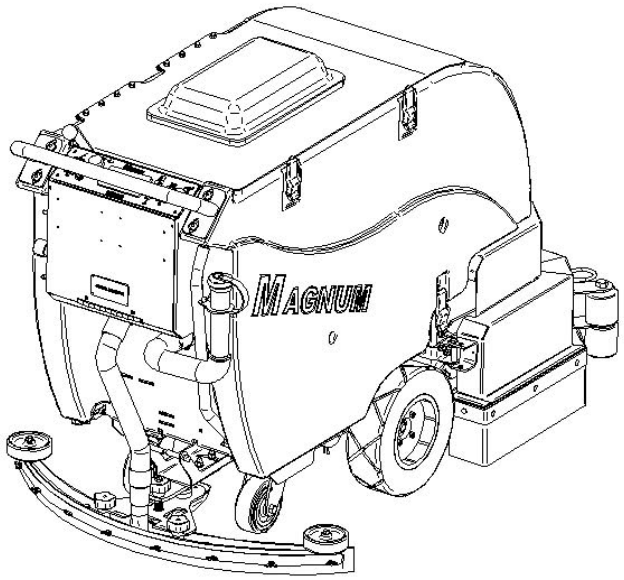

From Previous Page
Check to make sure the spacers, washers and springs are all there and in working order.
Are there missing parts?
Replace parts and adjust squeegee
NO
Verify the measurement where the front of the triangle plate bolts to the towbar. There should be EXACTLY 7/8" clearance on all machines except the 390/420 series.
Operate the machine and verify squeegee operation
Does the machine work properly?
YES
Bill the customer
It there proper clearance there?
NO
Adjust the clearance.
YES
Check cable clearance & slack
NO
YES
Is there proper clearance and slack?
NO
Adjust clearance and/or slack
Operate the machine and verify squeegee operation
Does the machine operate properly?
YES
Call the factory
NO

SQUEEGEE LIFT SYSTEM

The squeegee lift system on the Magnum was designed with simplicity in mind. It has very straight forward operation and minimal parts to assure consistent and highly reliable operation.

TO OPERATE

Move the squeegee lift lever from right to left. The squeegee will drop and the vacuum motor will then run. To turn off the vacuum motor, move the squeegee lift lever from left to right. The squeegee will be raised and the vacuum motor will turn off after a time delay.



SQUEEGEE LIFT ADJUSTMENTS

There are no provisions for adjustment of the squeegee lift. If the squeegee is not raising and lowering properly it is due to bent or worn part or parts. Inspect the lift assembly and other related systems for bent or worn parts and replace as necessary.

SQUEEGEE LIFT ELECTRICAL CIRCUIT

Although the squeegee lift is a manual lift there is an electrical circuit that it is tied to. When the squeegee lever is moved it actuates a switch. This switch send a signal to the controller telling it that the squeegee is down on the floor. When it sees this signal it turns on the vacuum motor. When the squeegee lever is moved to lift the squeegee up, the switch in no longer depressed and the signal going to the controller is interrupted. When the controller no longer sees the signal for the vacuum motor it runs the vacuum motor for 21 additional seconds to clear any excess water from the squeegee hose and then it turns off the vacuum motor.

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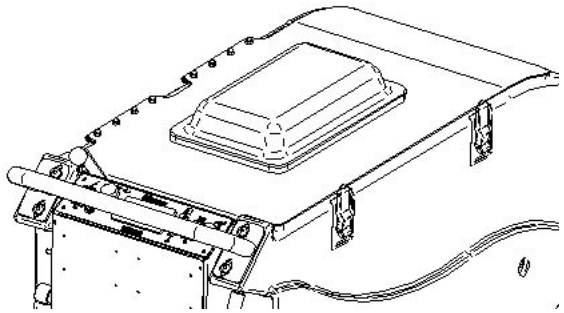
RECOVERY SYSTEM

The recovery system of the Magnum series is powered by a 24 volt 550 watt vacuum motor. The recovery tank is designed with a large lid to facilitate 100% access for complete cleaning out the recovery tank when use of the machine is finished. The vacuum motor draws air in through the squeegee tool, through the squeegee hose and into recovery tank. The water travels with the air flowing through the system and falls out of the air when it reaches the recovery tank. The air then passes through the vacuum saver and out through the vacuum motor. The recovery tank is equipped with a clear lid that allows the operator to observe the conditions inside the recovery tank as well as the recovery water level inside. Inside the recovery tank there are 4 major components. The recovery lid, drain saver, vacuum float and the water baffle.

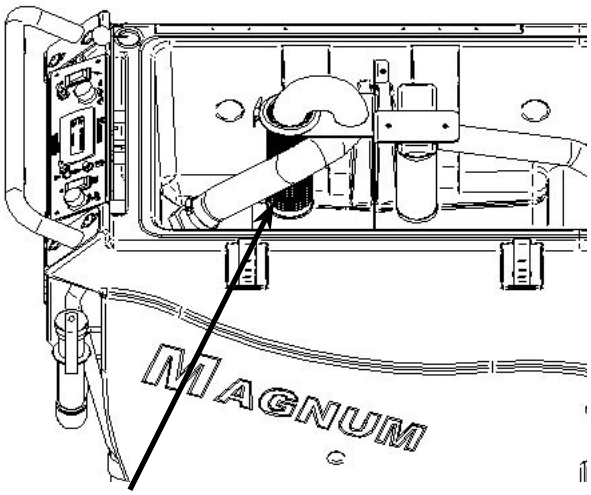
RECOVERY LID

The recovery lid is made from 1/8” thick stainless steel with a clear dome. The dome is to provide you with the ability to see the condition of the recovery tank during operation.



DRAIN SAVER

The drain saver is located inside the recovery tank and is accessed by opening the recovery lid. It is designed to collect large debris that is picked up by the squeegee so it does not settle in your recovery tank or clog the drain hose.



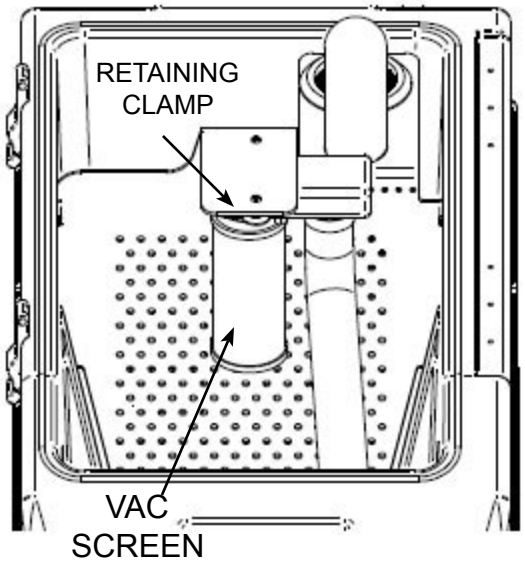
DRAIN
SAVER

VACUUM FLOAT

The vacuum float assembly is located inside the recovery tank and is accessed by opening the recovery tank lid. The float assembly stops the flow of air in the event that the recovery tank is filled to capacity.

BAFFLE ASSEMBLY

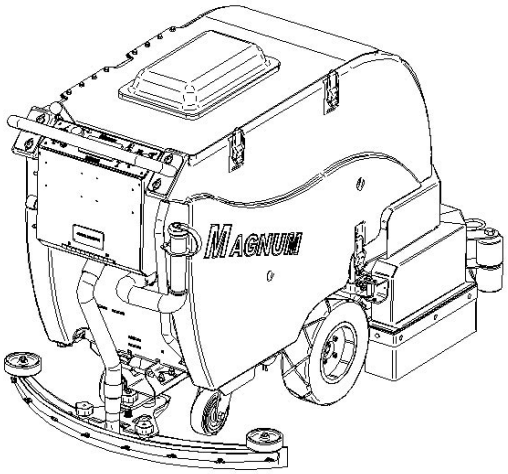
The baffle assembly is also located inside the recovery tank and accessed by opening the recovery tank lid. The baffle adds rigidity to the tank walls and lessens the sloshing of the water inside the recovery tank.



To clean the vacuum float:
Remove the white retaining clamp from the screen.
Pull the vac screen / float ball assembly off the vac box.
Rinse with hot water. Scrub with a brush if necessary
Dry thoroughly.
Replace vac screen / float ball assembly onto vac box.
Replace and tighten clamp.

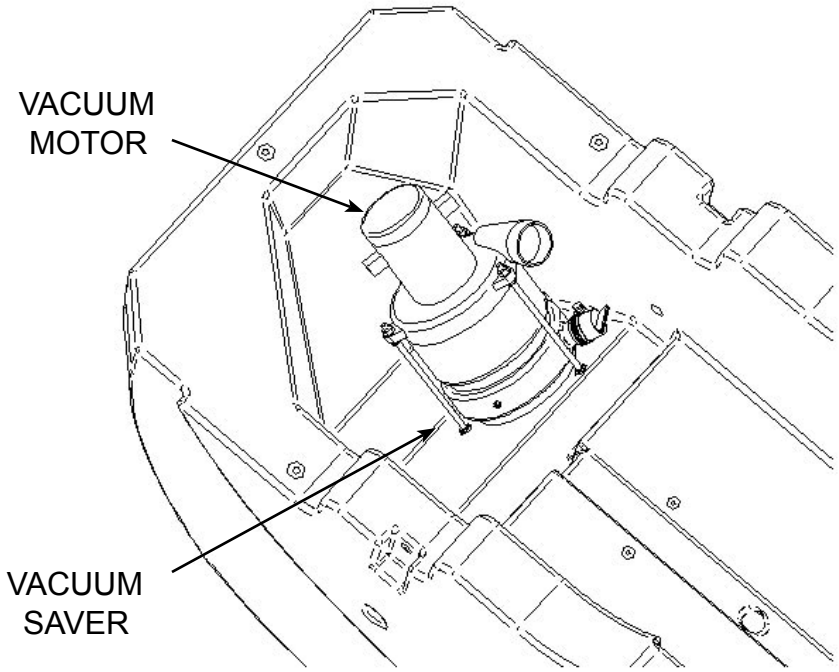
DRAIN HOSE

To drain the recovery system we have a poly hose with an integrated flow control feature. By squeezing the hose you can control the flow of the recovery tank as it is being emptied. The hose cap is attached to the hose with a tether to help prevent loosing it.



VACUUM MOTOR

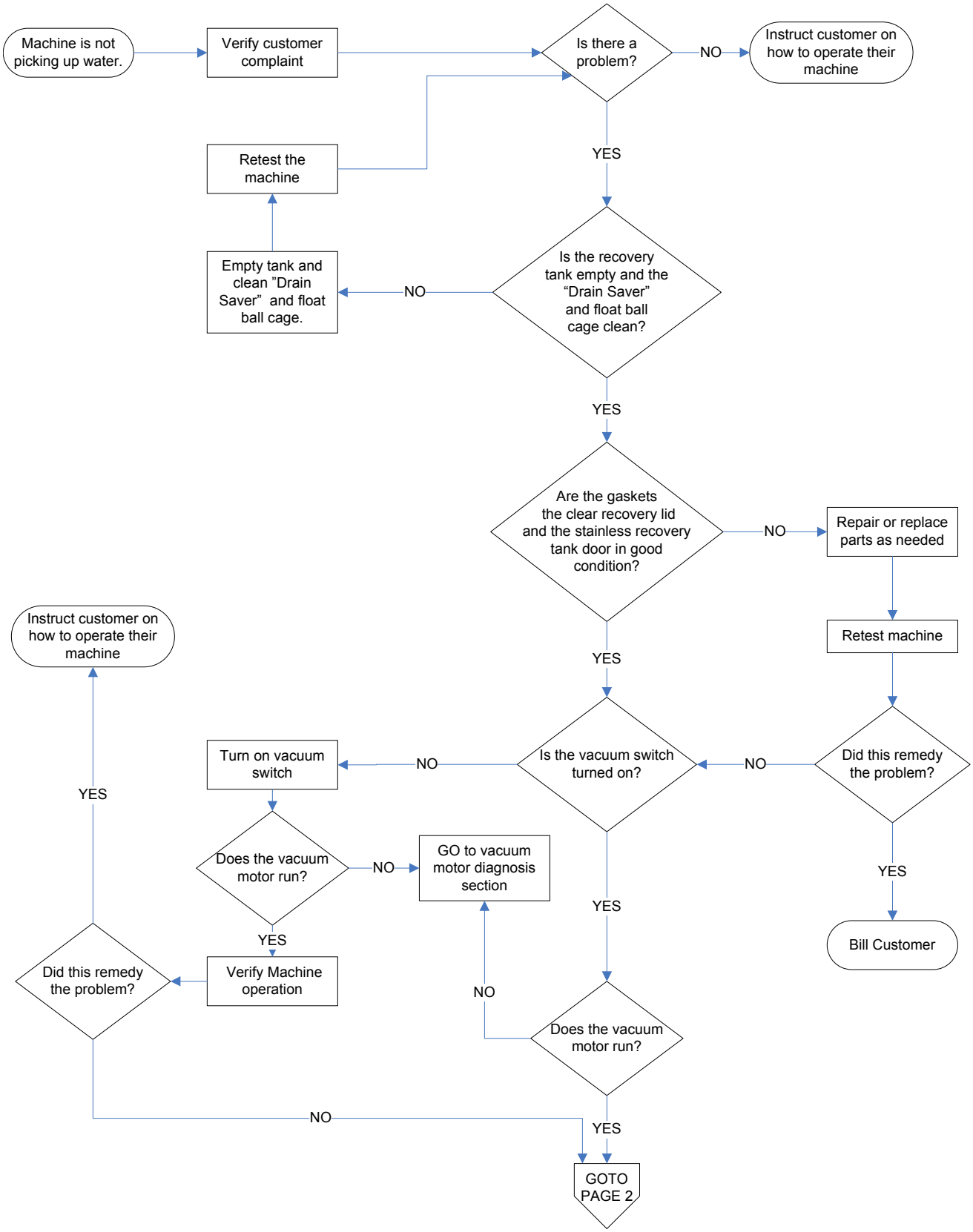
The vacuum motor used on the Magnum series scrubbers is a high efficiency, shunt would motor. The motor runs a approximately 12, 000 RPM. The motor is rated at 550 watts and has 72" of water lift. Although the motor has service parts available it is advised to replace the entire motor as all the motor parts have about the same life and repairs are usually cost prohibitive.



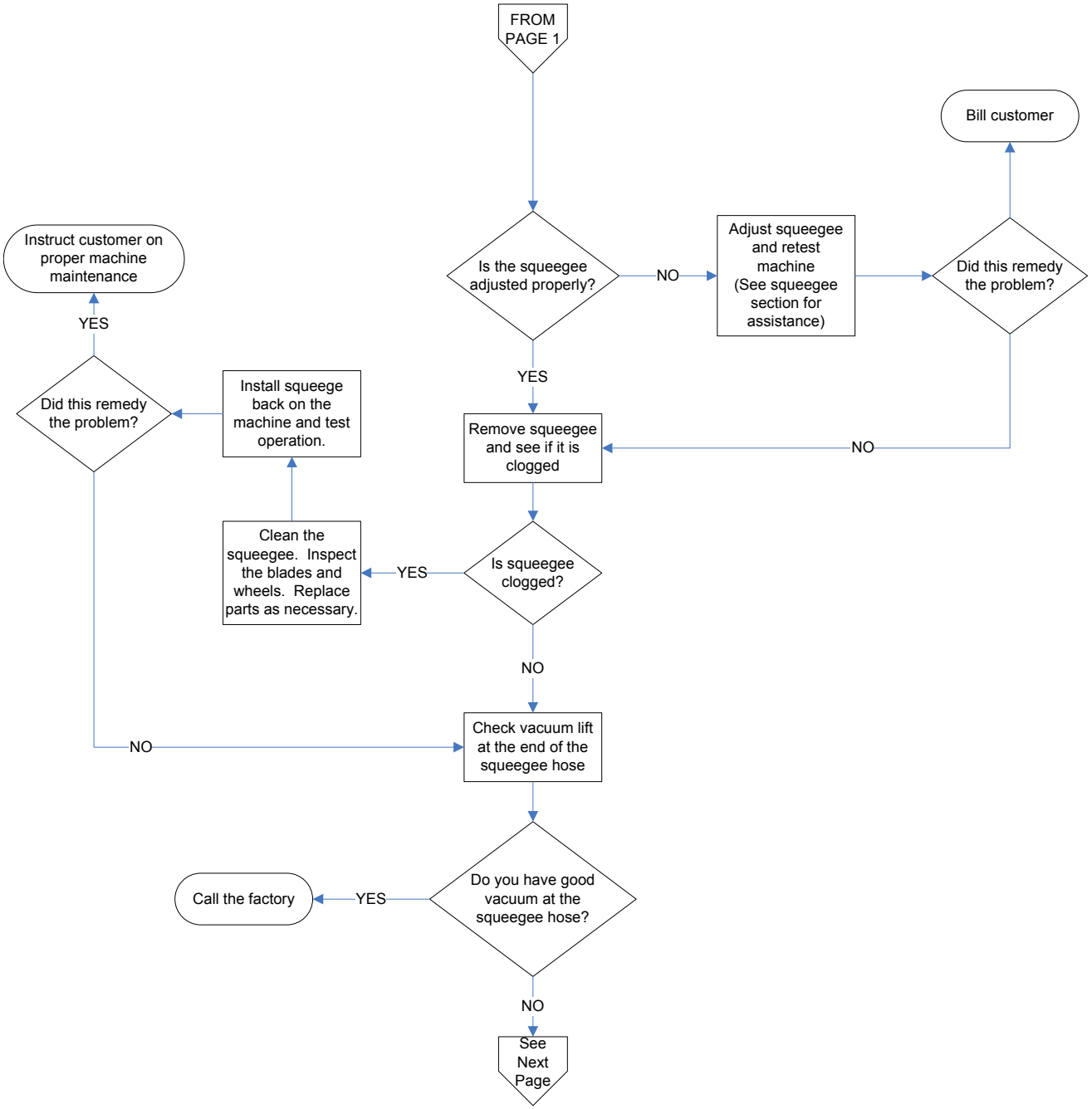
VACUUM SAVER

The Magnum is equipped with a vacuum save demising chamber that allows the moisture that gets through the recovery tank. The vacuum saver is a chamber that allows moist air to condense and has an automatic drain valve to empty the chamber each time the vacuum motor is turned off.

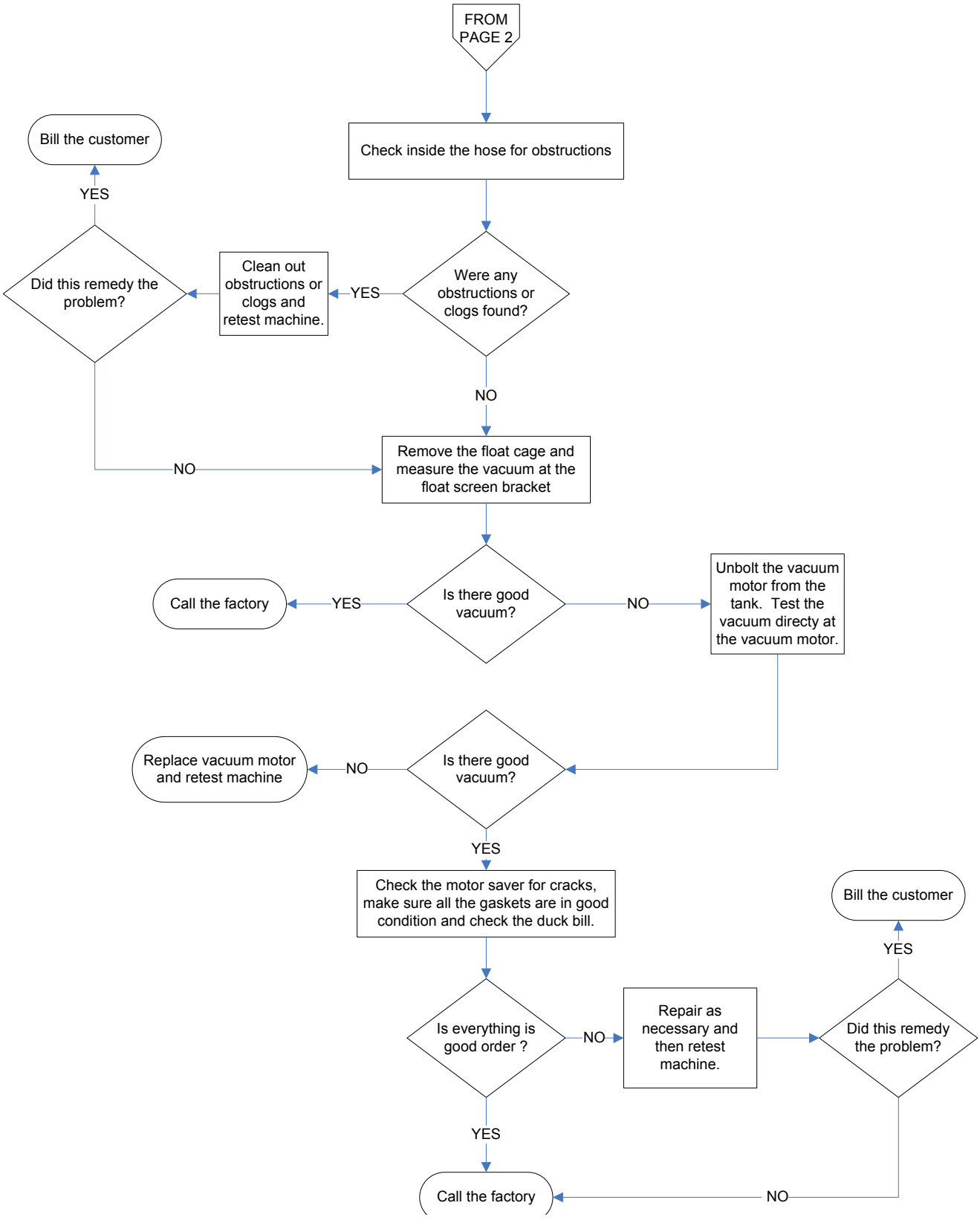
MAGNUM RECOVERY SYSTEM DIAGNOSTIC FLOW CHART
1 of 3



MAGNUM RECOVERY SYSTEM DIAGNOSTIC FLOW CHART
2 of 3


FROM PAGE 1
Is the squeegee adjusted properly?
NO
Adjust squeegee and retest machine (See squeegee section for assistance)
Did this remedy the problem?
Bill customer
YES
NO
Remove squeegee and see if it is clogged
Is squeegee clogged?
YES
Clean the squeegee. Inspect the blades and wheels. Replace parts as necessary.
NO
Check vacuum lift at the end of the squeegee hose
Do you have good vacuum at the squeegee hose?
YES
Call the factory
NO
See Next Page
Did this remedy the problem?
YES
Instruct customer on proper machine maintenance
NO
Install squeege back on the machine and test operation.

MAGNUM RECOVERY SYSTEM DIAGNOSTIC FLOW CHART
3 of 3


FROM PAGE 2
Check inside the hose for obstructions
Were any obstructions or clogs found?
YES
Clean out obstructions or clogs and retest machine.
Did this remedy the problem?
YES
Bill the customer
NO
Remove the float cage and measure the vacuum at the float screen bracket
NO
Is there good vacuum?
YES
Call the factory
NO
Unbolt the vacuum motor from the tank. Test the vacuum directy at the vacuum motor.
Is there good vacuum?
NO
Replace vacuum motor and retest machine
YES
Check the motor saver for cracks, make sure all the gaskets are in good condition and check the duck bill.
Is everything is good order ?
NO
Repair as necessary and then retest machine.
Did this remedy the problem?
YES
Bill the customer
YES
Call the factory
NO

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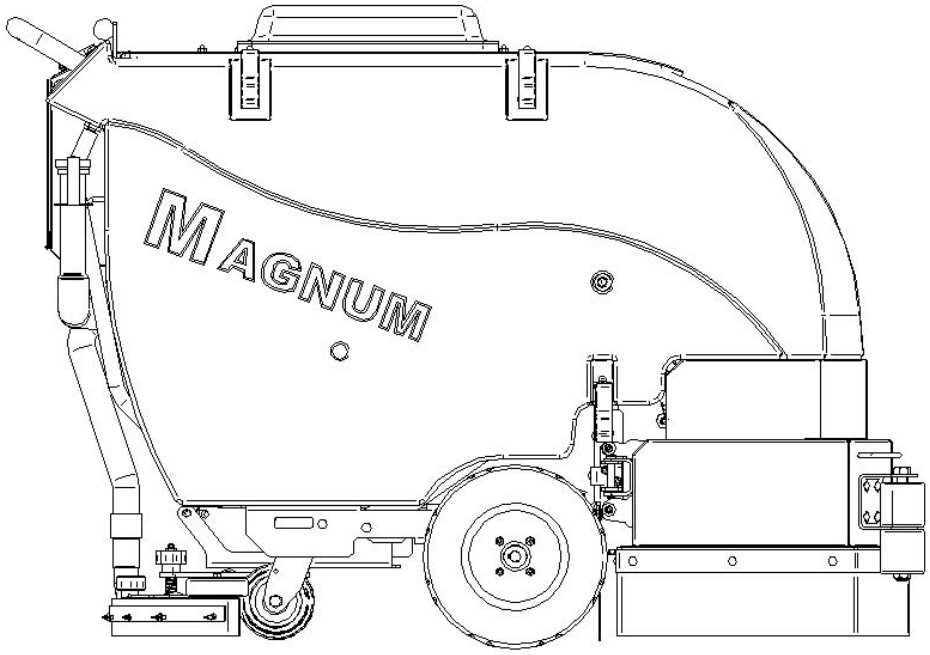
SOLUTION SYSTEM

The solution system on the Magnum series consists of main body of the machine which is also the solution tank, the fill opening, sight gauge/drain, filter, potentiometer, controller, and solution solenoid valve. The solution is turned on automatically when the brush deck is turned on and turns off automatically when the brush deck tuns off. The volume of solution is controlled by the solution potentiometer located on the control panel. The potentiometer sends a varied voltage signal to the controller and the controller interprets this signal and sends power pulses down to the solution solenoid valve. The more solution that is called for, the longer the length of the power pulse. When the potentiometer is turned to the MAX solution setting the valve receives constant power when the scrub deck is running. When the potentiometer is set to the MIN. position the solution solenoid valve receives no power even when the brushes are running. The solution runs through an in-line filter with a screen and a bowl attached to capture particles or debris that moves thought the solution system. The screen and bowl need to be cleaned on a regular basis.

THE SOLUTION TANK IS MADE OF HIGH DENSITY PLASTIC. THIS PLASTIC STARTS TO DEFORM AND LOOSE ITS SHAPE AT 180 DEGREES FAHRENHEIT. NEVER USE WATER HOTTER THAN 135 DEGREES FAHRENHEIT!



DISPENSING SOLUTION

Make sure the recovery tank is at least 1/2 full with desired scrubbing solution. Adjust solution control knob near the center of travel. Turn on the brush deck switch. Activate the machine by pressing either of the green handlebar buttons. The solution will start to flow when the brushes start and stop flowing when the brushes stop. Turn the solution control potentiometer while scrubbing to adjust solution volume.

SOLUTION SYSTEM ELECTRICAL CIRCUIT

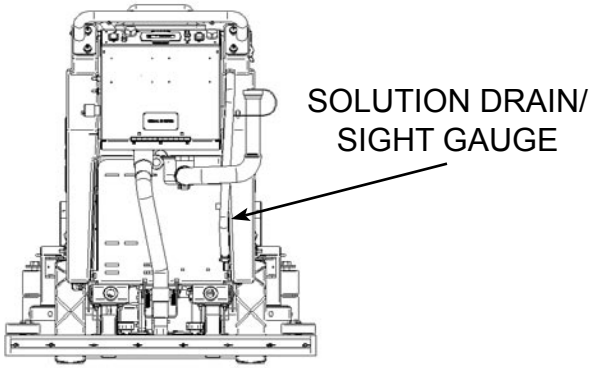
The electrical circuit of the Magnum series is divided into two parts. The input circuit and the output circuit. The input circuit consists of the controller, the scrub switch and the solution potentiometer. The controller produces a high (5 volt) and a low (0 volt) signal that is sent to the potentiometer the potentiometer outputs a varied voltage from 0 to 5 volts. The controller also sends a 5 volt signal to the scrub switch. When the scrub switch is turned on this 5 volt signal is sent to the scrub input on the controller and the controller then looks at the input from the solution potentiometer. When either handle bar button is pushed the controller then starts the scrub brushes and sends pulses of electricity to the valve. The more water requested

ADJUSTING SOLUTION FLOW

To adjust the solution flow use the solution potentiometer located on the control panel. To increase the amount of solution turn it counter clock wise. To decrease the amount of solution being dispensed turn it clockwise. Changing the amount of solution dispensed is done by changing the amount of time the solution solenoid valve is open for every second.

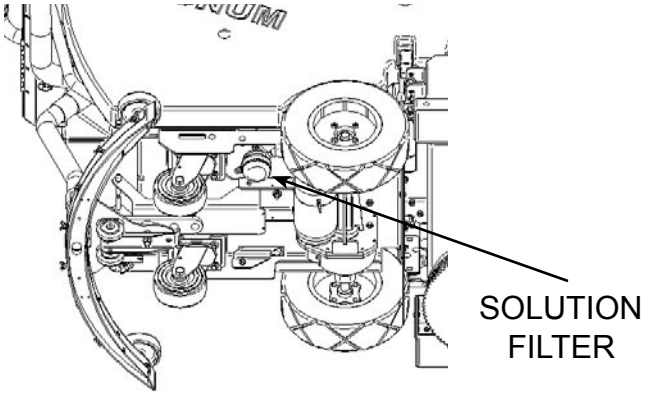
DRAINING SOLUTION TANK

Detach the solution drain / sight gauge hose from the upper barb and lower into a suitable drain or receptacle. When the solution has emptied reattach the hose to the upper barb.

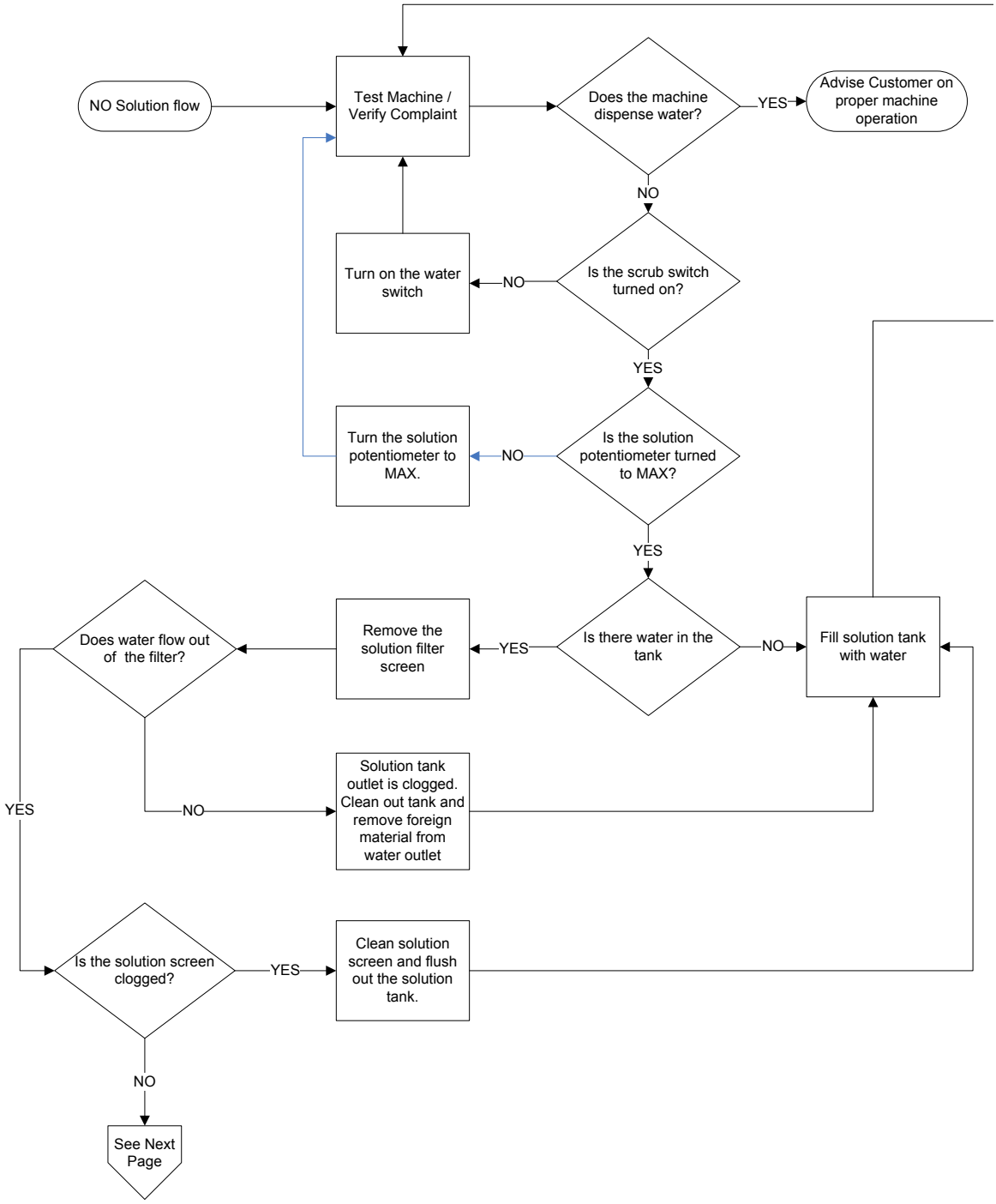


CLEANING SOLUTION FILTER

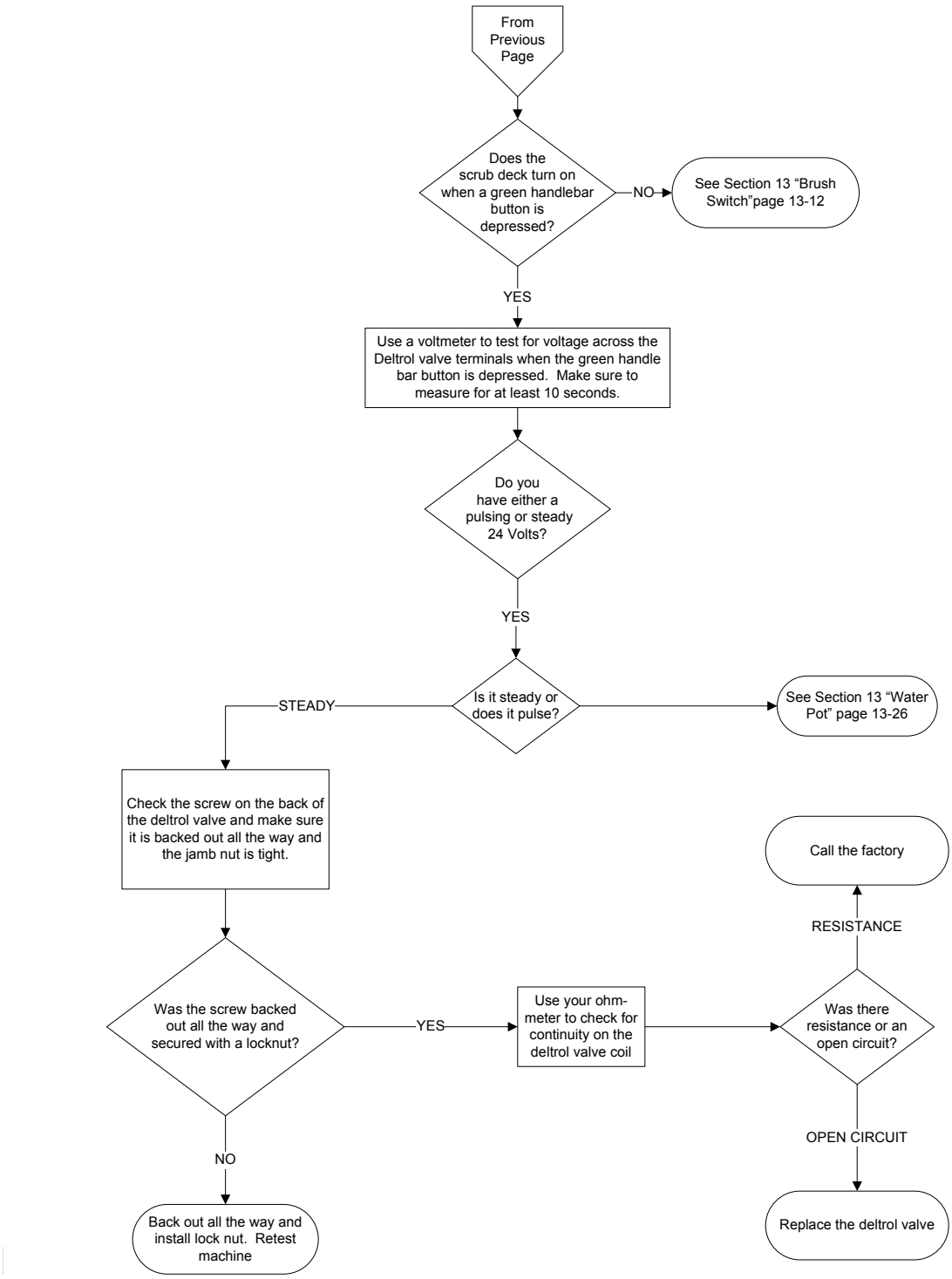
Drain solution tank with the drain hose. Reach under the machine and unscrew and remove the clear part of the plastic filter housing. Remove screen and clean. Replace screen and clear part of filter housing.



SOLUTION SYSTEM DIAGNOSIS FLOW CHART 1 of 2



SOLUTION SYSTEM DIAGNOSIS FLOW CHART 2 of 2

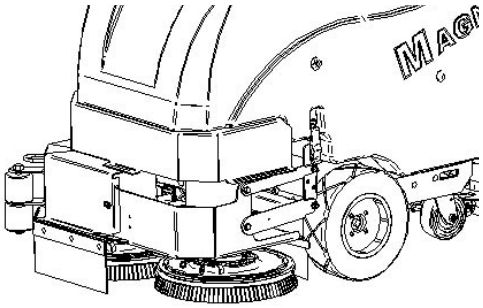

From Previous Page
Does the scrub deck turn on when a green handlebar button is depressed?
NO
See Section 13 "Brush Switch"page 13-12
YES
Use a voltmeter to test for voltage across the Deltrol valve terminals when the green handle bar button is depressed. Make sure to measure for at least 10 seconds.
Do you have either a pulsing or steady 24 Volts?
YES
Is it steady or does it pulse?
STEADY
See Section 13 "Water Pot" page 13-26
Check the screw on the back of the deltrol valve and make sure it is backed out all the way and the jamb nut is tight.
Call the factory
RESISTANCE
Was the screw backed out all the way and secured with a locknut?
YES
Use your ohm-meter to check for continuity on the deltrol valve coil
Was there resistance or an open circuit?
NO
OPEN CIRCUIT
Back out all the way and install lock nut. Retest machine
Replace the deltrol valve

BRUSH DRIVE SYSTEM

The brush drive system on the Magnum Series comes in two versions. The disc type and the cylindrical type. Each one has its own merits although they do the same thing which is turn the scrub brush or scrub pad.

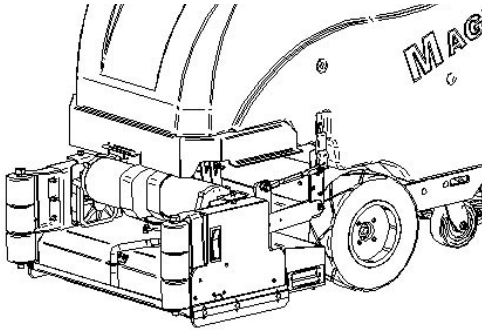
DISC

The disc brush drive system consists of the controller, 2 brush drive motors, 2 brush driver hubs and 2 scrub brushes or 2 pad holders. The drive hub is a “gimbaled” design that helps compensate for irregularities of the floor. Only original factory equipment brushes should be used on this machine or premature scrub motor failure may occur. “Will-Fit” brushes are usually not concentric and promote bearing failure”



CYLINDRICAL

The cylindrical brush drive system consists of the controller, 2 brush drive motors, 2 drive belts, 2 brush idlers, 2 circuit breakers and two scrub brushes. Each scrub motor has it’s own circuit breaker to protect it individually against overload in the event of individual brush motor overload.



BRUSH DRIVE ELECTRICAL CIRCUIT

The brush drive circuit is very simple. A positive and negative wire run from the controller to the scrub deck. On cylindrical machines there is a protection circuit breaker wired in line to each of the motor brushes. The controller watches the amperage draw on the scrub motors and regulates the brush deck pressure to keep the motors operating at a consistent amp draw thus maintaining a consistent deck pressure. The cylindrical decks have independent motor protection on them because the motor demand can vary so greatly from one brush to the other and the controller views them as one motor.

SETTING BRUSH PRESSURE

The scrub deck pressure is adjusted continuously while scrubbing. Using the brush pressure switch on the control panel you set the desired scrubbing pressure. The desired brush pressure is shown on a bar graph on the LCD display. There are 5 different settings to choose from. The controller is programmed with an amp value for each of 5 brush pressure settings. When the scrub deck starts the controller calculates the amp draw of the motors and compares it to the amp value of the current brush pressure setting. If the motors are not drawing enough amps the controller lowers the brush deck to increase the brush pressure on the ground and therefor raise the amp draw of the motors. If the amp draw of the motors is higher than the target amp value the controller raises the brush deck to relieve down pressure from the brush deck therefor reducing the amp draw of the brush motors because they can then turn more easily.

BAR GRAPH DISPLAY

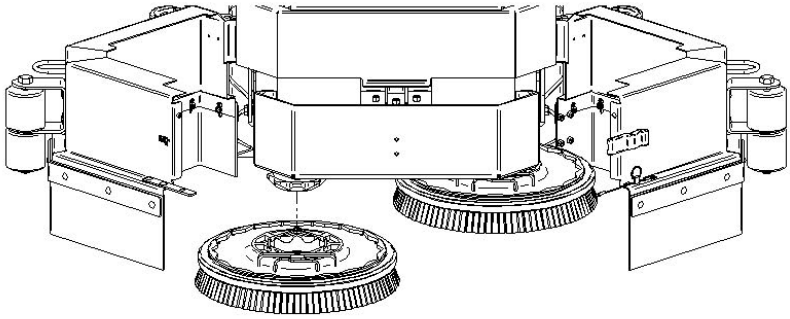
BRUSH PRESSURE SWITCH

INSTALLING & REMOVING BRUSHES

DISC MACHINES

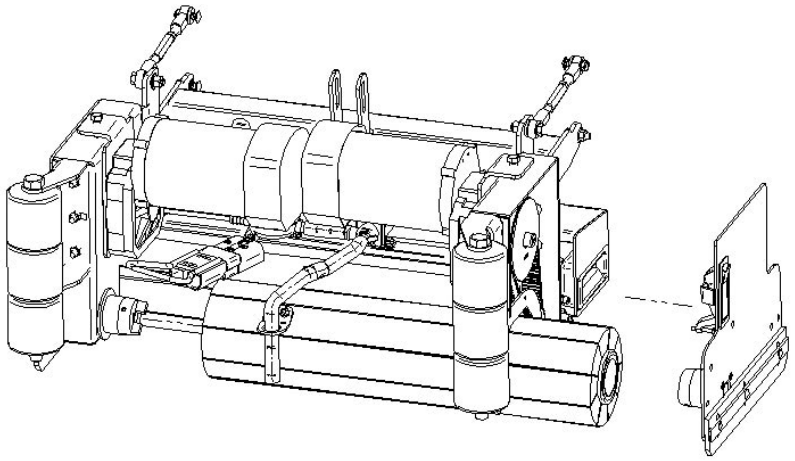
With the machine turned on, turn off the brush deck switch. Turn machine power off. Open the two latches on the jaws and swing them aside. Rotate each brush until both tabs of the spring clip are accessible. Squeeze the two tabs together and the brush will drop off. If the brush deck does not raise high enough to remove the brushes. Turn the machine power on for 10 seconds and then off again. Then try removing the brushes again. If the brushes still can not be removed due to lack of space the actuator or linkage must be adjusted.

To install a brush reverse the procedure.



CYLINDRICAL DECK

With the brush deck raised, remove the side access door from the scrub deck. Grasp the scrub brush and pull and it will slide off the brush driver and out from under the scrub deck. To install brushes align brush with the brush drive and push until the brush slides down onto the driver. Install the access door back onto the brushes. If the access door does not fit up to the brush deck completely the brushes are not situated on the drivers properly. Realign the brushes until they slip onto the drivers completely and the access door sits tightly against the brush deck and latch will close easily.



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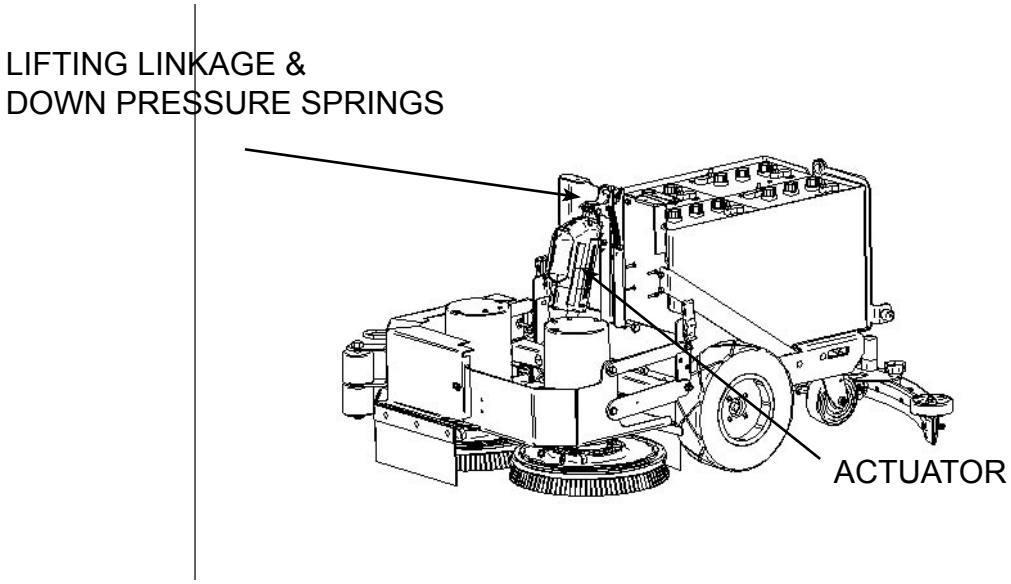
BRUSH LIFT SYSTEM

The active brush lift system on the Magnum series consists of an actuator, down pressure springs, scrub switch and the controller. The brush deck is raised and lowered by the brush deck actuator which is driven by the controller. The actuator circuit is internally protected from electrical overload by the controller. The active bush lift system is used to lower the brush deck when scrubbing is started and raise it when stopped. The controller continually monitors the amperage draw of the scrub brushes and raises and lowers the scrub deck accordingly to keep the motors drawing a consistent amount of amperage thus keeping the scrub pressure uniform.



BRUSH LIFT ELECTRICAL CIRCUIT

The brush lift electrical circuit itself is a very simple circuit. It consists of two wires that run from the controller to the actuator. Power is applied to the actuator with the polarity in one direction to raise the brush deck and the opposite direction to lower the brush deck. The actuator has internal limit switches that prevent it from moving too far in either direction. While the circuit itself is very simple, the control of this circuit is very complicated. The controller operates the output of this circuit by monitoring a number of variables. Is important to know this circuit energizes the brush deck actuator to raise the brush deck for 4 seconds each time the controller is powered up. For this reason it is important to make sure all body parts are clear from under the scrub deck when the machine is powered on. When the scrub switch is turned on the controller runs the scrub brushes down toward the floor for a predetermined amount of time. This is known as dock time and can be modified by chang-

ing the parameters of the controller. When the throttle button is depressed the controller monitors the amp draw of the brush motor and adjusts the scrub deck height to obtain the target amp draw on the scrub motors. The target amp draw of the motors is set using the brush pressure switch on the control panel. The brush pressure setting is shown on the LCD display in the form of a bar graph. The target amps for each of the brush pressure settings are defined by the parameters that are programed into the controller. When the throttle of the machine is released the scrub brushes raise up off the floor for 2 seconds. This is called raise time. The purpose of this is so the scrub brushes start up under reduced load which leads to much longer motor life. Raise time can be modified and is set through programing. If scrubbing begins again the brushes drop back down to the floor and the controller again starts analyzing the brush motor amp draw and adjusting the scrub deck pressure accordingly. When the scrub deck switch is turned off the scrub head raises for four seconds to it's fully raised position,

DOWN PRESSURE

Down pressure is regulated by the controller on the machine as. The desired brush pressure is selected by using the brush pressure switch on the control panel. The brush pressure selection is read out on the LCD display in the form of a bar graph.. The bar graph is segmented in to 5 levels the lowest being 1 bar and the highest being 5 bars. The pressure relative to each of the settings is programed into the controller and are fully adjustable..

BRUSH LIFT SYSTEM ADJUSTMENTS

The brush lift system has two adjustments that can be made. The first adjustment is the length of travel of the actuator ram. This controls how far down it will allow the brush deck to go. The second adjustment is the upper linkage adjustment that controls how high the brush deck will lift off the floor .

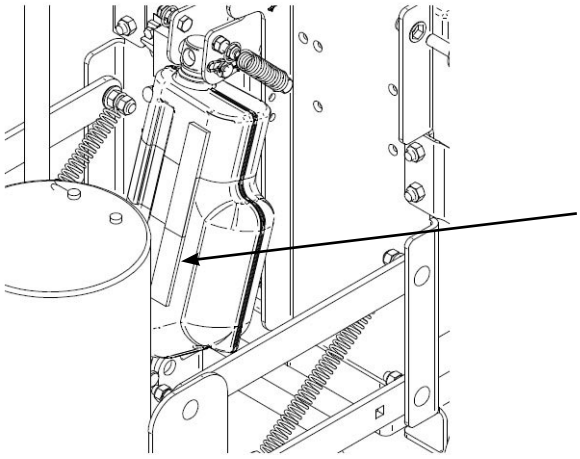
To access the actuator and its linkage the body of the machine must be tipped back. To do this you must first drain the solution and recovery tanks completely. Then release the 2 soft latches directly above the scrub deck on either side of the machine. Now use the handle bars to tip the body of the machine backwards carefully until the strap stops it. After the adjustments have been made, tip up the body, secure the two soft latches and test the machine.

BRUSH LIFT ACTUATOR

The actuator must be able to extend enough to lower the brush head down so that it can reach slight dips in the floor. If the head can not do this the actuator may not be extending enough. The distance the actuator extends is controlled by a limit switch that is housed internally in the actuator.

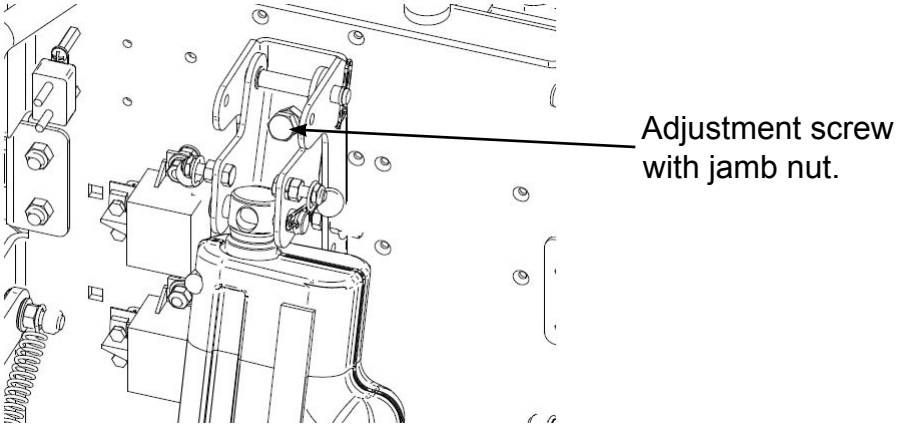
ACTUATOR ADJUSTMENT

To access the limit switch in the actuator remove the black rubber strip on the face of it. Loosen the set screw just enough for the switch to slide. To increase the travel of the deck slide the limit switch down toward the floor. To increase the travel slide the limit switch up towards the top of the machine. When the switch is repositioned gently tighten the set screw and replace the black rubber strip.



LINKAGE ADJUSTMENT

If the brush deck is out of adjustment and it can not be remedied with the limit switch adjustment there is a provision for adjusting the linkage. At the top of the brush deck lift linkage there is a bolt that is secured with a jamb nut. This bolt is used to increase or decrease the raised height of the deck. If too much adjustment is made to this screw to lift the brush deck, the deck may not have enough travel to reach and put pressure on the ground.



If the brush head lifts too high when it is in the full-raised position it may not have enough travel to extend low enough to reach into recesses in the floor. If the machine exhibits this condition, lower the overall brush height by backing out the screw on the upper suspension arm.

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TRACTION DRIVE SYSTEM

The Magnum series of scrubbers is powered by and electric transaxle system. The trans-axle is self contained and bolts to the bottom of the frame. The trans-axle is equipped with a 1/2 horsepower motor that transfers power through a shear key into the differential assembly. The power is then transferred out to the wheels via the axle shafts. The transaxle with the differential powers the machine while allowing the machine to turn easily.

TRACTION DRIVE ELECTRICAL CIRCUIT

The traction drive electrical circuit consists of the traction drive motor, controller, handle bar buttons, potentiometer and the reverse switch. When you engage the handlebar button it sends a signal to the controller and the controller then energizes the traction motor propelling the machine forward. When the reverse switch is engaged it sends 2 signals to the controller. One signal instructing the machine to move backwards and one signal instructing it to move. The controller then energizes the drive motor to propel the machine in reverse. Both the forward and reverse speeds are regulated by the potentiometer located on the control panel. The controller has internal protection for the drive motor. It will slow the machine down if the traction motor draws too many amps for more than 60 seconds. If the overload continues the controller will shut off the motor and show a diagnostic code on the LCD display. The motor can be damaged if repeatedly overloaded in a short time. The average amp draw for transport is 7-9 amps at full speed with all other functions off.

AXLE

The trans axel we use on the magnum scrubber has a 1/2 HP motor mated to a differential assembly The axel has only 4 serviceable parts on it. The motor, the shear key, the wheel mounts and the tires.

DRIVE MOTOR

The drive motor is a separately serviced part and is easily replaced.

TIRES & WHEELS

The tires are available in 2 styles. The standard equipment is a pneumatic tire that provides very good traction in most applications but is subject to puncture from sharp objects. The optional tire is a solid rubber tire with a steel hub. This tire offers superior traction and it will not go flat.

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CHASSIS SYSTEM

The chassis system on the Magnum series is built on a heavy duty 7 gauge powder coated full frame. The frame gives the machine great strength and durability. Everything is fastened to the frame using stainless steel hardware allowing for easy servicing should a repair be needed. .

CHASSIS REPLACEMENT

In the unlikely even that the chassis must be replaced due to collision or damage it can easily be done. We recommend transferring the components piece by piece from the old chassis to the new chassis and installing the tank last on the new chassis.

TIRES

There are 5 different tire options for the Magnum series of scrubbers. We offer pneumatic tires as a standard tire, grey tires for non marking applications. Both the black and grey tires are available foam filled but come with a 90 day warranty. There is also a HD tire option which is a solid tire

CASTERS

There are 2 different types of casters available on the Magnum series. There are the red polyurethane casters which provide very good resistance to oil and grease and roll very well making the machine easier to steer. There are also grey rubber tires which are a softer tire making the machine roll a bit smoother but they do not hold up well in solvents or harsh environments.

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BATTERY SAFETY

DANGER OF EXPLODING BATTERIES

Batteries contain sulfuric acid and produce explosive mixtures of hydrogen and oxygen. Because self-discharge action generates hydrogen gas even when the battery is not in operation. Make sure batteries are stored and worked on in a well ventilated area. ALWAYS wear ANSI Z87.1 (U.S. Standard) approved safety glasses and face shield or splash proof goggles when working on or near batteries.

Always wear proper face, eye and hand protection.
Keep all sparks, flames and forms of combustion away from the battery.
Never try to open a battery with non-removeable vents.
Keep removable vents tight and level except when servicing electrolyte.
Make sure work area is well ventilated.
Never lean over battery while boosting, testing or charging.
Exercise caution when working with metallic tools or conductors to prevent short circuits and sparks.

SAFE CHARGING

Never attempt to charge a battery without first reviewing the instructions for the charger being used. In addition to the manufacturer's instructions, these general precautions should be followed:

Always wear proper eye, face and hand protection.
Always charge batteries in a well ventilated area.
Keep vents tight and level.
Turn the charger and timer "OFF" before connecting the leads to the battery to avoid dangerous sparks.
Never try to charge a visibly damaged or frozen battery.
Connect the charger leads to the battery; red positive (+) lead to the positive(+) terminal and black negative(-) lead to the negative (-) terminal. If the charger is equipped with a quick disconnect plug use that to connect it to the machine.
Make sure that the machine and all its accessories are turned off.
Make sure that the charger leads to the battery are not broken, frayed or loose.
Set the timer, turn the charger on and slowly increase the charging rate until the desired charging rate is reached.
If the battery becomes hot, or if violent gassing or spewing of electrolyte occurs reduce the charging rate or turn off the charger temporarily.
Always turn the charger "OFF" or unplug it from the AC power before removing the charger leads from the battery or disconnecting the quick disconnect plug to avoid dangerous sparks.

HANDLING BATTERY ACID

Battery acid, or electrolyte, is a solution of sulfuric acid and water that can destroy clothing and burn the skin. Use extreme caution when handling electrolyte and keep an acid neutralizing solution - such as baking soda or house hold ammonia mixed with water - readily available. When handling batteries:

Always wear proper eye, face and hand protection.
If the electrolyte is splashed into an eye, immediately force the eye open and flood it with clean, cool water for at least 15 minutes. Get prompt medical attention.
If electrolyte is taken internally, drink large quantities of water or milk. DO NOT induce vomiting. GET IMMEDIATE MEDICAL ATTENTION.
Neutralize with baking soda any electrolyte that spills on a machine or in a work area. After neutralizing, rinse contaminated area clean with water.

WATER

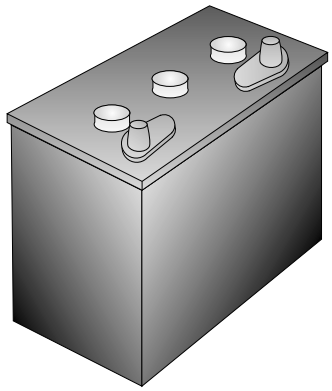
When servicing batteries the recommended water to use is distilled water when adding it to the electrolyte. However, any water that is safe to drink, with the exception of mineral or flavored waters, is safe to use in a battery. Do not use water with a high mineral content. Avoid using metal containers to store acid or water. The metal impurities in the water will diminish the performance of the battery. Liquids besides water such as vinegar, anti-freeze, salt water and alcohol or harmful acids such as nitric, hydrochloric or acetic will cause severe grid damage and completely ruin a battery.

BATTERY TERMINAL TYPES

Batteries are made with an assortment of different battery terminal configurations. The most common in the industry are listed here. It is best to replace batteries with the exact type of battery that was in the machine including the battery terminal type. If you change battery terminal types the battery cables must be changed to match the new style terminals..

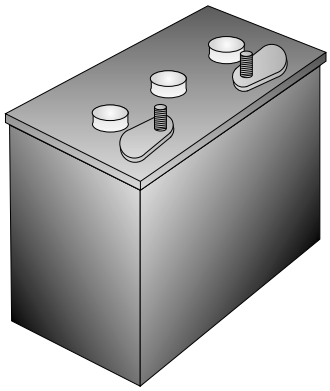
TAPERED TOP TERMINAL (S.A.E. POST)

The tapered top design uses terminal posts built to SAE standards so that all SAE style clamps will fit any battery with these posts. The negative terminal is made slightly smaller than the positive to reduce the possibility of hooking up a battery in reverse.



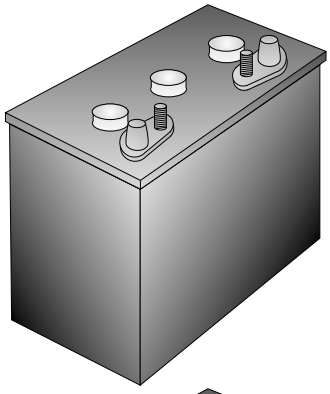
STUD TERMINAL

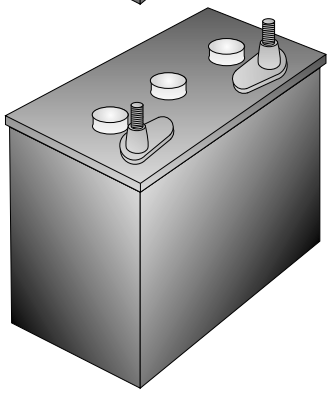
The stud terminal is typically used on heavy duty batteries. The terminals have a stainless steel threaded stud embedded in them that the connections are made to.



COMBINATION TERMINAL

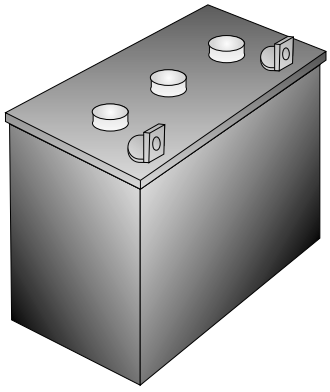
The combination terminals come in a few different configurations. The two most common configurations are the “side by side” and the stacked. In the side by side there is a tapered top terminal with a stud terminal right next to it. In the stacked configuration the stainless steel stud is embedded into the taper top terminal. The combination terminals make it possible to use the battery with a variety of equipment without having to change the cables on it. CAUTION: The “stacked type” combination battery terminals are very tall in comparison to all other configurations. Make sure to check all clearances before trying to close a cover or a tank on top of these types of batteries.





THE “L” TERMINAL

The “L” type terminal is used on many special application batteries.



BATTERY SYSTEM

The battery system for the Magnum series consists of either 2 - 12 volt or 4 -6 volt deep cycle batteries. They are offered in 3 different sizes of lead acid and 2 sizes of maintenance free gel battery for each machine. The batteries are the power source for all of the working parts of the machine and must be maintained properly to realize optimal run time as well as longevity.

Deep cycle batteries provide large storage capacity of the electricity that powers the scrubber. There are two types of batteries that we use in our scrubber and each one has different needs to keep it performing optimally.

BATTERY MAINTENANCE & CARE

LEAD ACID BATTERIES (TRADITIONAL)

Lead Acid Batteries are the most common battery installed in our machines. They are filled with water and battery acid and require periodic care. The most important item to attend to is the battery water level. This must be checked on a weekly basis because if the batteries run low on water they will be ruined. Batteries should be checked before you charge them to make sure they have enough water to cover the plates inside them. In the event that the water is below the tops of the plates water should be added to bring the level just above the top of the plates. When adding water ALWAYS use distilled water. Tap water contains things like minerals and chlorine that is detrimental to a battery. Batteries should be charged each time the machine is used for any significant time. Batteries should never be discharged more than 80% of their capacity. The battery gauge is to alert you when it is time to stop using the machine and recharge it. The tops of the batteries must be kept clean and dry or they will induce a current leak across the top of the battery.

LEAD ACID BATTERIES (MAINTENANCE FREE)

Some of our machines are equipped with ‘Maintenance free” lead acid batteries. The major difference between these and the “traditional” type of lead acid battery is that you can not check or fill the water in them.

GEL CELL BATTERIES

Gel Cell batteries are a maintenance free battery design that has no liquid to spill out in the event that a machine would be tipped over or some other disaster were to occur. The batteries perform well but not as well as a “traditional” flooded wet cell. With gel cell batteries there is no water level to check so there is less maintenance involved. With gel batteries the machine should be charged anytime it is used for any significant length of time. Gel cell batteries should never be discharged below 60% of their capacity, 21 volts on this machine, or it will cause rapid failure of the battery.

BATTERY CABLES & TERMINALS

The battery cable connections must remain tight and corrosion free. In the event that the battery cables or terminals become corroded follow accepted battery safety precautions, disassemble and clean the terminals with a baking soda and water solution and a wire brush, making sure not to get any INSIDE the battery. Once the terminals and cables are clean and dry, inspect them thoroughly for any damage or signs of arcing or over-heating. Replace and damaged cables, terminals or batteries. Reassemble the cables and batteries and coat terminals and connections with a battery terminal protectant.

IMPORTANT NOTE! Make sure to apply the protectant AFTER the batteries and cables are reassembled and tightened. Putting protectant on before assembly and tightening can lead to a fire.

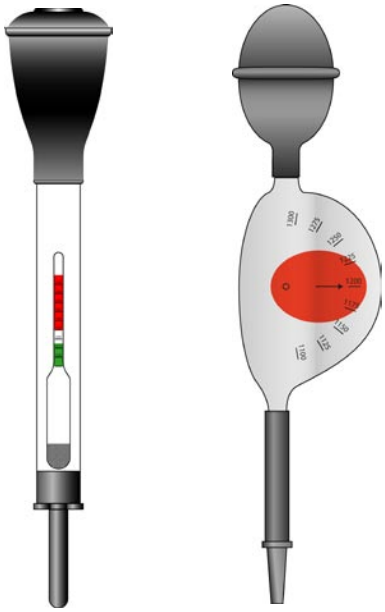
BATTERY TESTING

As a battery pack ages, the batteries will slowly loose their ability to accept and hold a charge. This will usually be noticed by a decrease in run time of the machine. Neglected batteries will “wear out” much faster than well-maintained batteries but give you similar symptoms when they do fail. The proper way to check a battery pack’s condition is with a battery discharge unit. To use the discharge unit make sure the batteries are maintained properly and fully charged. Attach the discharge unit to the machines battery pack and turn the machine on. Record your results and compare them to your battery’s rated capacity. This will let you know how much capacity your battery pack has left. If you find through the battery discharge meter that you have reduced capacity you can test each individual battery to find out if you have one bad battery or multiple bad batteries. To test each battery you have 2 options, a hydrometer test or a load test.

Hydrometer test:
Use a hydrometer on each cell in the battery pack to check it’s specific gravity.

HYDROMETERS

There are 3 types of hydrometers typically available. We do not recommend the floating ball type as they are not very accurate and give minimal information regarding the batteries condition. The traditional “float type” hydrometer and the “EZ Red” or dial type hydrometer give a numeric reading of each battery cell’s state of charge.



FLOAT TYPE DIAL TYPE

The state-of-charge of a lead acid battery can be determined by the specific gravity of the electrolyte (its weight compared to water). The specific gravity can be measured directly with a hydrometer or determined by the stabilizing voltage.

A hydrometer is a bulb-type syringe which will extract electrolyte from a cell. A glass float or a plastic disk in the hydrometer body is calibrated to read in terms of specific gravity. A common range of specific gravity used on these floats is 1.160 to 1.325. Do not assume a battery will not take a charge because you have been charging it for a while and the float will not rise. The battery may have been fully discharged and will require considerable charging time before reaching the minimum specific gravity on the float.

The lower the float sinks in the electrolyte, the lower its specific gravity. The proper way to read a hydrometer is to dray electrolyte into the body of the hydrometer while holding it vertically so the float is not rubbing on the side of it Draw an amount of acid into the body so the that with the bulb fully expended, the float will be lifted free not touching either side, the top or the bottom. Your eye should be level with the surface of the liquid in the hydrometer body. Disregard the curvature of the liquid where the surface rises against the float stem and the barrel due to surface tension. Keep your hydrometer and it's float clean. Check them frequently for cracks.

The following table illustrates typical specific gravity values for a cell in various stages of charge with corresponding voltage readings.

OPEN CIRCUIT VOLTS	STATE OF CHARGE	HYDROMETER READING
12.65	100%	1.260 or more
12.45	75%	1.225 - 1.260
12.24	50%	1.190 - 1.225
12.06	25%	1.120 - 1.190
11.89	Totally Discharged	1.120 or less

When testing with a load tester you are looking for a difference between cells of the batteries. All the battery cells should have similar readings. Any battery that contains a cell that has a value lower than .050 of the rest of the cells indicates you have a bad battery.

Load test with a load tester:
Make sure batteries are fully charged. Disconnect batteries from the machine and each other so each battery can be tested individually. Using a battery load tester test each battery at either the fixed load of the tester or a 120 amp of load on a variable tester. The batteries should be able to maintain a voltage of 10.8 volts or greater for 15 seconds on 12 volt batteries and 4.9 volts or greater for 15 seconds on a 6 volt battery. If they can not maintain their voltage while under load they are bad.

Load test using machine systems as a load:
Using a volt meter measure the voltage of each battery while the machine is under full load (all systems operating). If any battery shows a voltage of less than 80% of the battery with the highest voltage that battery is bad.

BATTERY REPLACEMENT

When replacing batteries in a machine it is important to replace them with quality batteries that are designed for high-output deep-cycle applications, such as the ones furnished by the factory when the machine was new. All batteries are NOT created equal. In the event you are considering other manufactures batteries make sure to compare their 75 AMP RESERVE CAPACITY. That is the ONLY specification that corresponds to the usage the batteries will be seeing.

When a battery fails in the first 12 months of operation replacing a single battery may be acceptable if the failure was caused do to manufacturing defect. If the battery pack is older than 12 months or the battery has failed due to neglect the entire battery pack should be replaced as the batteries operate as a system.

When replacing batteries it is important to neutralize any battery acid that is in or on the machine after battery removal. Clean and dry the machine after neutralization and removal of any acid. The batteries should be installed in a clean and dry machine.

When installing batteries a terminal protectant should be used to help inhibit battery terminal corrosion. It is important to use a product specifically designed for this and not things like grease, silicone or paint. Read and follow the directions on the can of protectant exactly to prevent terminal or cable failure.

BATTERY CHARGERS

There are 2 different chargers available for the Magnum series machines. We offer an off-board charger standard with the machine and an on-board charger is available as an option.

OFF-BOARD CHARGER

The standard charger supplied with the Magnum is a fully automatic charger. To operate the charger all that needs to be done is plug it into the machines charger port and then plug it into the wall. Once the charger is plugged into both the charger port on the machine and a wall outlet it will run until the batteries are fully charged and then shut off. It is important to let the charger finish its charge cycle before disconnecting it as the last few hours of a charge cycle are very important.

The charger has an amp meter on the face of it to show how much electricity is being put into the batteries and it gives some idea of where the charger is in its cycle. Typically on a good set of batteries when you plug in the charger and it turns on, the meter will move rapidly to the high end of the amp scale. As the charge cycle progresses, the meter will fall towards zero. The charger shuts off automatically when the cycle is complete, this is evident by it not humming anymore.

ON-BOARD CHARGER

An on-board charger is offered as an option on the Magnum series of machines. The charger is a waterproof charger that is mounted right to the chassis of the scrubber. It is operated by simply plugging the power cord into the wall. The charger then will run through its charge cycle and automatically shut off. The automatic charger has 4 status lights on it.

The LED Function Chart below describes the charging process.
NOTE: The LEDs discussed below in the table are the Charge Status LEDs.
NOTE: The AC present LED (green #2) is lit at all times when AC is connected, and off when AC is not connected.

Display	Operating condition
Red = on Yellow = off Green#1 = off	When the red LED is on, it indicates that your battery is discharged and the model 2820-24-03 is recharging the battery at the "Bulk" rate (stage 1). This charging rate is approximately 20 Amps. While the red LED is on, the voltage measured (with the charger on) will be approximately 23 to 28 Volts. If an excessive amount of time is taken to complete this stage, the charger will time out and present a fault indicator. (see section 5.)
Red = on Yellow = on Green#1 = off	When both the yellow and the red LED' s are on, it is charging at the " absorption" rate. (Stage 2). During this second charging stage, the charger holds the battery voltage at approximately 29 VDC, and gradually reduces the amount of current delivered to the battery. If an excessive amount of time is taken to complete this stage, the charger will time out and present a fault indicator. (see section 5.)
Red = on Yellow = on Green#1 = on	When all three charge status LEDs are on, the model 2820-24-03 is charging at a "Finish" rate of 5 Amps, (Stage 3). The "Finish" stage will charge the battery up to approximately 30.5 – 32 VDC. If an excessive amount of time is taken to complete this stage, the charger will time out and present a fault indicator. (see section 5.)
Red = off Yellow = off Green#1 = on	When the green#1 LED is on, and red and yellow are off, the charge cycle is completed and the battery is ready for use. At least 100% of charge has been returned to the battery. If the battery voltage falls below approximately 24 VDC, the charger will automatically restart the charge process.

ON BOARD CHARGER TROUBLE SHOOTING

Problem	Cause	Solution
Red LED stays on for more than 18 Hrs.	One or more defective or damaged cells. Charger has reduced its output voltage below the normal level due to a DC overload or a DC short. On-board DC systems are drawing more current than the charger can replace. Excessive ambient temperature has forced the charger to cutback output current in order to self protect.	Load test the batteries and replace if necessary. Remove the source of the overload or short. Disconnect the charger' s black (NEGATIVE) ring terminal from the battery. Reapply AC power and the green LED only should now light. Turn off all DC equipment while charging. Determine the cause of the excessive ambient temperature and correct.
The red and yellow LED' s stay on for more than 10 Hrs.	On-board DC systems are drawing in excess of 10 amps. One or more defective or damaged cells. Extremely low AC voltage at the battery charger.	Turn off all DC equipment while charging. Load test the batteries and replace if necessary. Apply a higher AC voltage source or reduce the length of the extension cord.
Green #1 LED stays on when the battery is known to be low.	Open DC output fuse. Faulty or contaminated terminal connections. One or more defective or damaged cells.	Replace DC output fuse with a 30 Amp Bussmann (MDA-30). Clean and tighten or repair all terminal connections. Load test the batteries and replace if necessary.
The AC Present Green#2 LED does not turn on when AC power is applied.	No AC power available at the charger Component failure	Connect AC power or reset the AC breaker on the main panel Return charger to the factory.
The yellow LED is blinking continuously.	1. Charge cycle has timed out, charging process took an excessive amount of time	1. See fault codes below.
The red LED is blinking continuously	1. Corrupt Microprocessor memory	See fault codes below. Return charger to the factory.

FAULT CODES

FLASHING RED LED: Corrupt program memory in micro controller detected, charger microprocessor has become corrupted. Charger must be returned to the factory.

FLASHING YELLOW LED: Timer has expired. The 253-2441 uses a timer to independently monitor each mode of the charge cycle: bulk, absorption and finish. If the timer expires during any of these modes of the charge cycle, there could be a problem with the battery set. The timer may expire if there is a damaged battery cell in the battery set, an abnormally high ambient temperature at the charger or some other external fault, which prevents completion of charge cycle. These problems need to be addressed by user intervention. Charger must be AC powered down and disconnected from the battery in order to reset fault condition. Before resetting the charger investigate potential problems with battery or other external faults. Once external problem is resolved, reconnect charger output cable and reconnect AC power

MAINTENANCE

Periodically clean both battery terminals with baking soda and tighten all connections. No other maintenance on the charger is required.

See the following chart as to what the light mean.
IMPORTANT NOTE! DO NOT unplug any charger's DC plug from the machine while the charger is running. This can cause an electrical arc that can ignite any flammable gasses that are in the area from either the batteries being charged or other environmental sources. There is also the possibility of damaging the charger should it be unplugged from the DC current side while charging.

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ELECTRICAL SYSTEM

The electrical system on the Magnum series is a 24 volt system. This is not a chassis ground system for safety reasons.

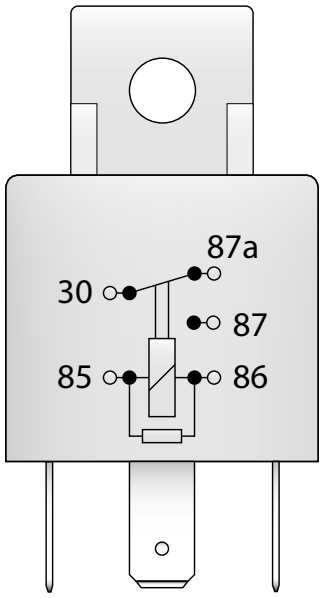
SWITCHES

The switches we use all have a similar face but are configured differently internally. Majority of them interface directly with the machine controller and carry low voltage signals. It is important to not that when diagnosing theses machines, NEVER jump battery power to the switches to test them as the controller can be instantaneously destroyed.

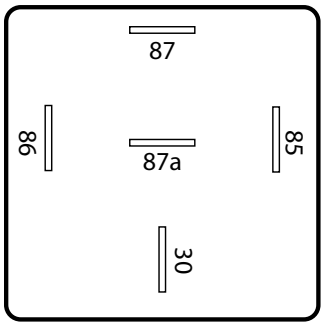
RELAYS

The Magnum series uses only one relay. This relay is used to power the buss bars and isolate them from the controller. There are relays internally mounted in the controller but these are not serviceable.

The relay we use is a 24V 15A Hella relay. This relay is energized by the key switch and is used to power the buss bars.



COIL SECTION
85 COIL LEAD
86 COIL LEAD



SWITCH SECTION
30 COMMON
87 NORMALLY OPEN
87a NORMALLY CLOSED

MOTORS

The motors that are used through out the machine are designed to be very durable and give long service life.

BRUSH DECK MOTORS

The brush deck motors are DC permanent magnet gear reduction type, they output large amounts of power for scrubbing. The motor brushes are replaceable and are rated to give 2000 hours of service life. See the “Brush Drive System” chapter 7 for more information.

VACUUM MOTOR

The vacuum motor is a very high speed motor that develops vacuum for the recovery system. The motors are designed to give a service life of 500 hours. See the “Recovery System” chapter 5 for more information.

ACTUATORS

The Magnum uses only one actuator. This actuator is for lifting the brush deck. This is a heavy duty 500 lb. actuator that has internal limit switches. See the “Brush Lift Section” Chapter 8 for more information.

WIRING

The wiring on the machine is numbered for easy circuit determination and to be easy to trace. We over size our wiring to eliminate failures and for safety reasons.

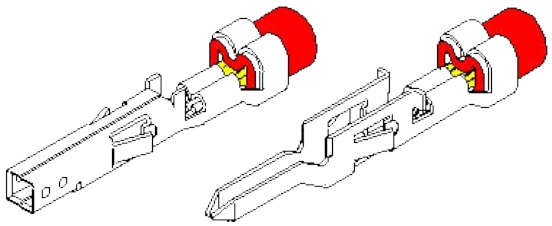
We use a number of different wire terminals on our machines and some require special tools to properly service or replace them.

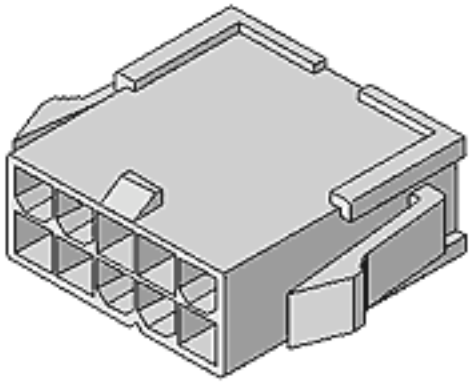
STANDARD CRIMP ON TERMINALS

The standard crimp on terminals we use on our equipment should be crimped with a positive stop ratchet type crimpers. The correct color coded terminal must be installed for the machine to operate properly with it’s original integrity. It is important to use the Ratchet style crimpers to assure the connector is installed properly. The ratchet style crimpers regulates the crimp so it is not too tight or too loose. Using standard pliers style crimping tools does not assure a consistent connection.

MOLEX CONNECTORS

Molex Mini Fit Jr. wire terminals are used where the wiring harness plugs into the controller and the LCD display. These terminals require a special removal tool. If an attempt to remove them is made without the removal tool it is very likely that the terminal and perhaps the connector will be damaged and need to be replaced. To replace a Molex Mini Fit Jr. terminal a special set of Molex brand crimpers is required to achieve an acceptable crimp.





REMOVAL TOOL

MOLEX MINI-FIT JR. CRIMPING TOOL

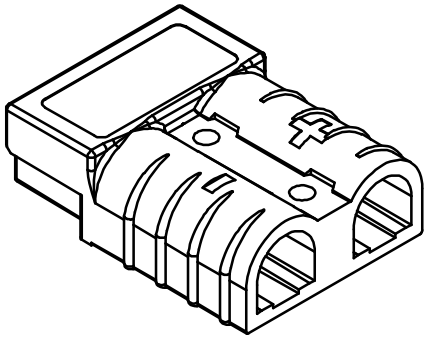
CONTROLLER HIGH AMP OUTPUT TERMINALS

(Brush, Vacuum, Traction)

The controller high amp output connectors are crimped with a special crimping tool at the factory. The tool is not practical to use in the field so in the event that a new terminal is needed a wire end kit is available that is field installable. This kit is available through the parts department.

ANDERSON BATTERY CONNECTORS

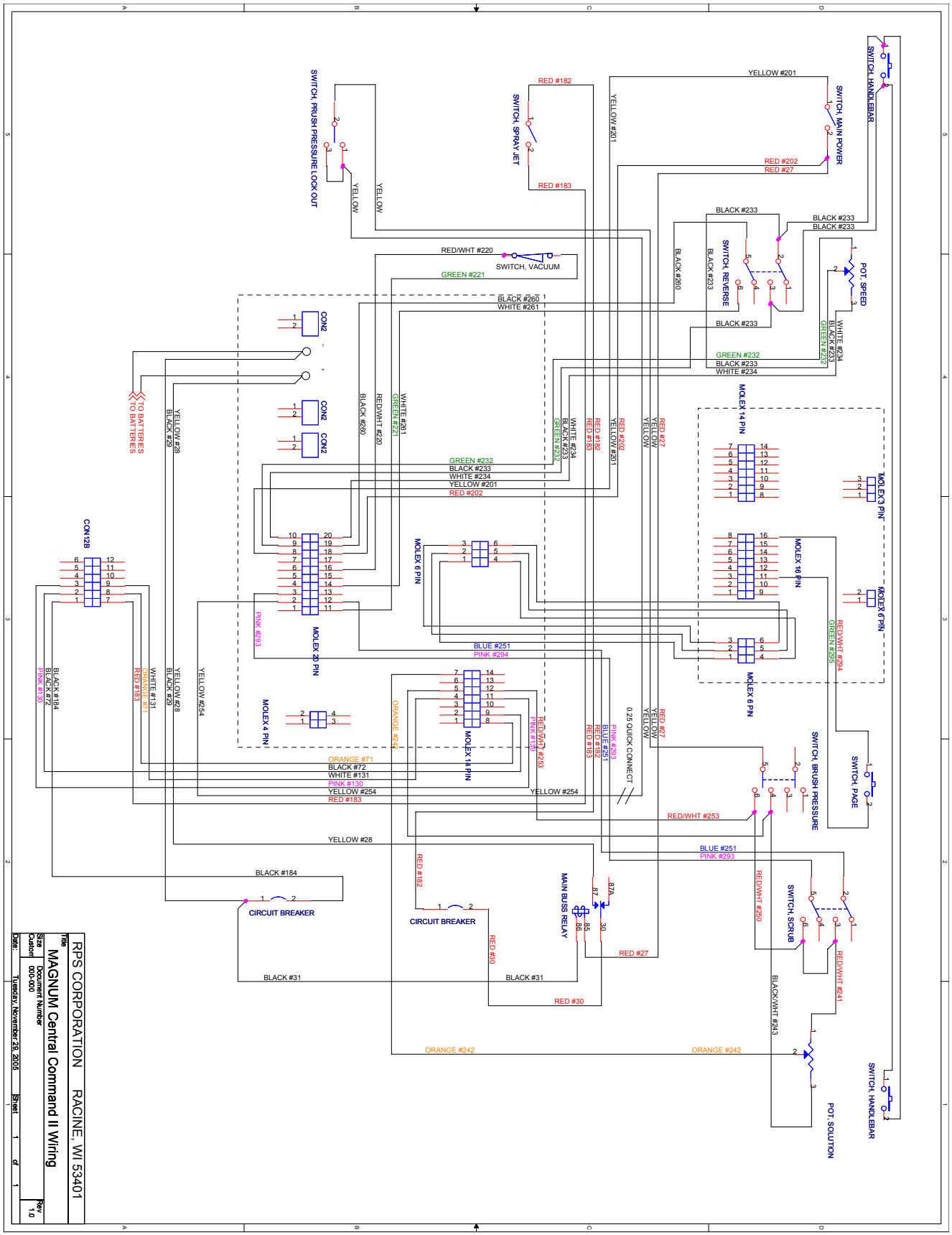
Anderson connectors are crimped by a hydraulic crimping machine at the factory. This is not practical in the field. We recommend using a manual staking tool and then soldering the terminal to assure a good solid connection.



ANDERSON CONNECTOR

ANDERSON CONTACT

MANUAL STAKING TOOL


SWITCH, HANDLEBAR
SWITCH, MAIN POWER
YELLOW #201
RED #202
RED #27
SWITCH, SPRAY JET
RED #182
RED #183
SWITCH, PRUSH PRESSURE LOCK OUT
YELLOW
SWITCH, VACUUM
RED/WHT #220
GREEN #221
SWITCH, REVERSE
BLACK #233
BLACK #260
POT, SPEED
WHITE #234
GREEN #232
BLACK #260
WHITE #261
CON2
CON12B
TO BATTERIES
YELLOW #28
BLACK #29
REDWHT #220
WHITE #261
GREEN #221
MOLEX 14 PIN
MOLEX 3 PIN
MOLEX 16 PIN
MOLEX 6 PIN
MOLEX 20 PIN
MOLEX 4 PIN
PINK #293
BLUE #251
PINK #294
REDWHT #294
GREEN #295
ORANGE #71
BLACK #72
WHITE #131
PINK #130
YELLOW #254
RED #183
0.25 QUICK CONNECT
SWITCH, BRUSH PRESSURE
SWITCH, PAGE
RED/WHT #253
BLACK #184
CIRCUIT BREAKER
RED #192
MAIN BUSS RELAY
87
87A
85
86
30
RED #27
RED #30
BLACK #31
REDWHT #250
SWITCH, SCRUB
REDWHT #241
BLACK/WHT #243
ORANGE #242
POT, SOLUTION
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Title
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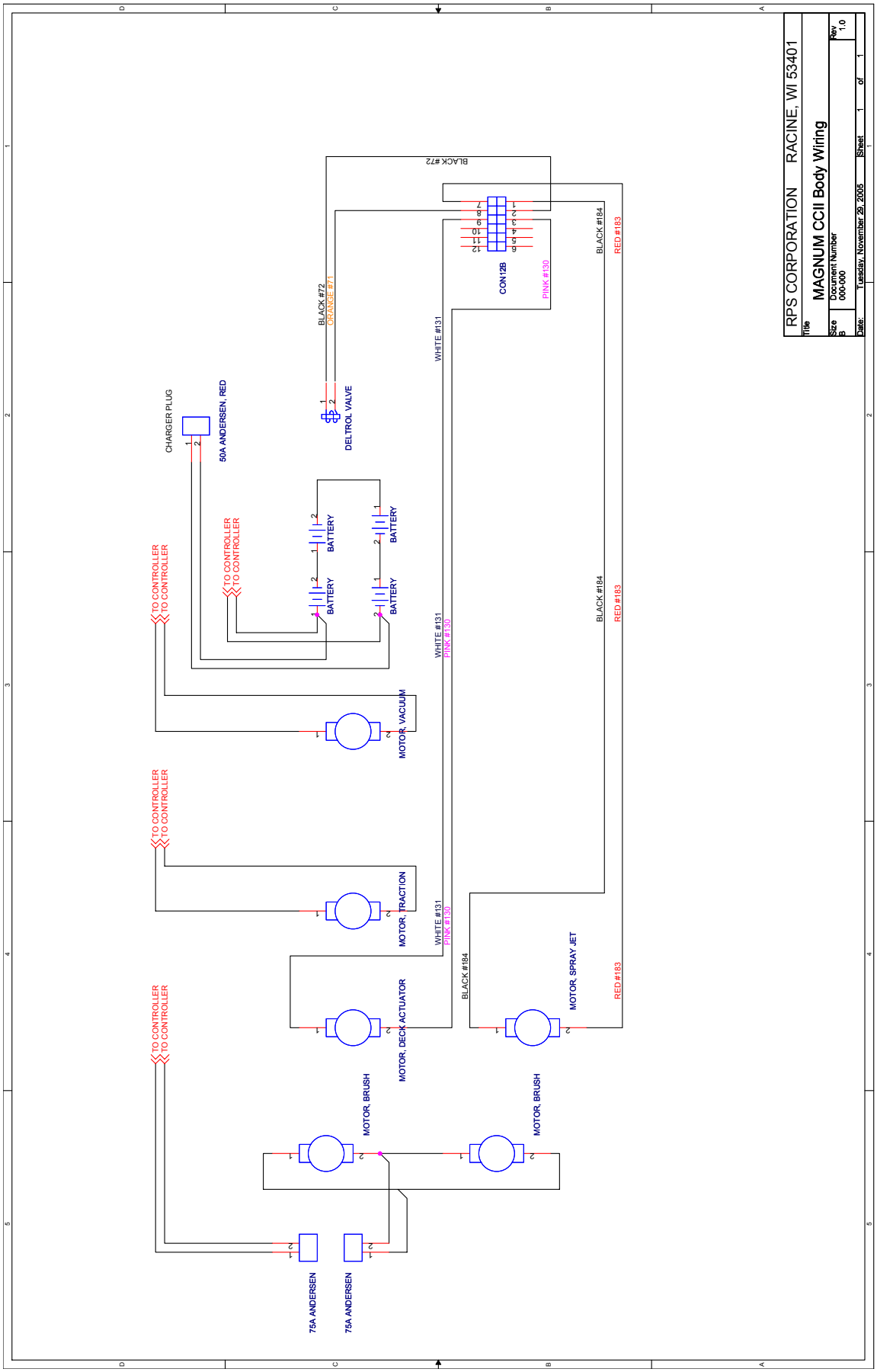
Size
Custom
Document Number
000-000
Date:
Tuesday, November 29, 2005
Sheet
1 of 1
Rev
1.0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Size B
Document Number 000-000
Rev 1.0
Date: Tuesday, November 29, 2005
Sheet 1 of 1
CHARGER PLUG
50A ANDERSEN, RED
BLACK #72
ORANGE #71
DELTROL VALVE
BLACK #72
CON12B
PINK #130
WHITE #131
BLACK #184
RED #183
BATTERY
BATTERY
BATTERY
BATTERY
TO CONTROLLER
TO CONTROLLER
TO CONTROLLER
TO CONTROLLER
MOTOR, VACUUM
MOTOR, TRACTION
MOTOR, DECK ACTUATOR
MOTOR, SPRAY JET
MOTOR, BRUSH
MOTOR, BRUSH
75A ANDERSEN
75A ANDERSEN

Wire Number	Terminal or Pin #	Component
1-19	**Battery Cables**	
1		Main + cable to the battery pack #1
2		Cable from 1st to 2nd battery
3		Cable from 2nd to 3rd battery
4		Cable from 3rd to 4th battery
5		Cable from 4th to 5th battery
6		Cable from 5th to 6th battery
7		Main - cable to the battery pack #1
8		Main + cable to the battery pack #2
9		Main - cable to the battery pack #2
10		Rapid Charge #1
11		Rapid Charge #2
12		Rapid Charge #3
13		Rapid Charge #4
20-39	**Main Power**	
20	- Buss	General 16 Gauge ground
23		General 16 Gauge (+) Positive
26		Pos (+) Battery Power to Key or Master switch
27		Power from main or key switch to main relay
28		Battery (+) to hella relay Pin 30
29		(-) battery to (-) buss breaker in
30		(+) Pin #87 on hella relay to (+) buss breaker in
31		(-) Pin #85 to (-) breaker out
32		(+) Buss breaker out
33		(-) Buss breaker out
40-59	**Drive System**	
50		Drive motor + 1
51		Drive motor - 1
52		Drive Motor + 2
53		Drive Motor - 2
54		Parking brake +
55		Parking brake -

60-79	Solution System	
65		Low solution output from switch
66		Low solution power to switch
67		Solution Pump Power Controlled (390 420 430)
68		Solution Pump Negative (390 420 430)
70		Supply voltage to switch (Non electronic controller machines only)
71		Deltrol valve + power
72		Deltrol valve - switched power

80-119	Vacuum System	
85		Vac Motor #1+
86		Vac motor #1 -
87		Vac motor #2 +
88		Vac motor #2 -
89		Vac Motor #1+
90		Vac motor #1 -
91		Vac motor #1 Control +
92		Vac motor #1 Control -
93		Vac motor #2 +
94		Vac motor #2 -
95		Vac motor #2 Control +
96		Vac motor #2 Control -
97		Vac Motor Cut Vac Switch Input
98		Vac Motor Cut Vac Switch Output
99		High Vac horn +
100		High Vac horn -
101		Vac Motor Relay (ONLY 390, 420, 430)
102		Vac Motor Relay (all except 390, 420, 430)
103		High recovery light +
104		High recovery light -
105	C2 / 10	Squeegee actuator +
106	C2 / 3	Squeegee actuator -
107		Vacuum "on" signal to relay (For Non Solid State controlled machines)
108		Vacuum power to circuit breaker
109		Vac Switch Input (Air Logic)
110		Vac Switch Output

USED ON ONLY 390, 420 and 430

120-139	Brush Drive / Main Broom System	
125		Brush drive motor +
126		Brush Motor to meter
127		Brush motor meter to circuit breaker
128		Brush motor solenoid to circuit breaker
129		Brush drive motor -
130	C2 / 11	Deck Actuator +
131	C2 / 4	Deck Actuator -
132		Deck actuator (+) power to the circuit breaker
133		Worn Motor Brush Indicator +
134		Worn Motor Brush Indicator -

140-159	Side Broom System	
145		Side Broom Motor (Right) +
146		Side Broom Motor (Right) -
147		Side Broom Motor (Left) +
148		Side Broom Motor (Left) -
149		Side broom Switch
150		Side broom Diode
151		Side broom switch input
152		Side broom switch output
153		Side broom diode input
154		side broom diode output

160-199	AUX / options	
170		Back up alarm B+ Power
171	C3 / 17	Back up alarm
172		Strobe +
173		Strobe -
174		Horn -
175		Horn Switch B+
176		Horn Switch output
177	+ Buss	Headlight +
178	- Buss	Headlight -
179		Filter Shaker Switch Input B+
180		Filter Shaker Switch Output
181		Filter shaker motor -
182		Spray Jet Switch B+
183		Spray Jet Switch Output
184		Spray Jet -
185		B+ to recycling switch
186		Recycling Switch output
187		Recycling B-
188		B+ to side broom water switch
189		Output from side broom water switch
190		Side broom water B-

200 - 299	Central Command System	
201	C3 / 8	Battery Power from the Penny & Giles to the main/key switch
202	C3 / 18	Power from the main or key switch back to the P&G controller
210	5V Ref	One Touch switch power in
211		One Touch switch output
220	5V Ref	Vac/Squeegee Switch Ref
221	C3 / 11	Vac/Squeegee Switch Output
222	C2 / 5	Vac Wand Switch Ref
223	C3 / 11	Vac Wand Switch Output
230		Handle bar buttons in (From center tap of speed pot)
231		Handle bar buttons out
232	5V Ref	Speed Pot High
233		Speed Pot Center
234	0V Ref	Speed Pot Low
240		Solution Switch
241	5V Ref	Solution Pot High
242	C2 / 7	Solution Pot Center
243	0V Ref	Solution Pot Low
250	5V Ref	Brush Switch input
251		Brush Switch Output
253	5V Ref	Momentary Brush Pressure switch Terminal 1
254	C3 / 2	Momentary Brush Pressure switch Terminal 2
255	0V Ref	Momentary Brush Pressure switch Terminal 3
260	0V Ref	Reverse switch input
261	C3 /13	Reverse switch output
270	C3 / 14	Inhibit Switch Input
271	5V Ref	Inhibit Switch output
280	C1 / 1	LCD Wire # 1
281	C1 / 2	LCD Wire # 2
282	C1 / 3	LCD Wire # 3
283	C1 / 4	LCD Wire # 4
284	C1 / 5	LCD Wire # 5
285	C1 / 6	LCD Wire # 6
290		E Stop Input
291		E Stop Output
292		Traction Mode Switch (1 pole of the brush switch) Input
293		Traction Mode Switch (1 pole of the brush switch) Output
294	5V Ref	LCD Mode Input (page switch)
295		LCD Mode Output (page switch)
296	0V Ref	Vac Switch (Air Logic)
297		Vac Switch Return

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COMPUTER CONTROL SYSTEM

The Magnum series of machines is equipped with the Central Command II control system. Central Command II is designed around a very powerful controller that is has a industrial computer integrated into it. The controller is linked to a Liquid Crystal Display (LCD) to relay information to the operator or the service technician. The same controller is used in majority of our equipment, both 24 and 36 volt, but runs a different “program” for each machine. The controller utilizes unitized construction eliminating many excess components from the control panel. The switches on the dash board send input signals to the controller. The controller then interprets the inputs via the program and operates the machine accordingly. The controller has internal protection for both current overload as well as thermal protection. A large circuit breaker is used on the power feed to the controller for extra safety against overload. In the event of a malfunction the Central Command II will display a diagnostic trouble code to aid in the repairing the machine.

CONTROLLER OVERVIEW

INPUTS

The controllers input section uses a technology called tri-state logic to interpret the input from the switches. The tri-state logic is comprised of low, medium and high voltages. The inputs have the mid voltage present at them until they are either drawn low or high by a switch.

OUTPUTS

The controller has a number of outputs and each one of them is electronically protected from overload. In the event of an overload the machine is shut down by the controller and a diagnostic trouble code is displayed on the LCD screen. On some of the outputs the current limit can be adjusted via software to control the amount of current available to the circuit.

PULSE WIDTH MODULATION

The controller uses a technology called pulse width modulation to control some of the output circuits. Motors and accessories can be run using this technology in more than one way. We can change the speed of a motor as well as control the amount of time a valve is open over one second, such as in our solution system. Pulse width modulation works by sending pulses of full battery voltage to the device 14,000 times a second. The length of the pulses determines the speed of the motor. This is a much more efficient way of running an electrical device at less than 100% operation.

CONTINUITY TESTING

Four of the outputs; traction drive, parking brake, brush & vacuum have a continuity checking feature that monitors the device and the wiring to it from the controller for an open circuit. This monitoring can be turned on and off for each circuit independently through the programming of the controller.

SOFT START

Three of the outputs; traction, brush & vacuum, have a soft start function on them. This function provides the ability to start and stop a motor gradually over a measured period of time, 0-10 seconds. This aids in the longevity of the motors and anything driven by them as it greatly decreases the shock load on them. The soft start settings are changed through the controller programming.

CONNECTIONS

There are 3 different types of connections that are used on the controller.

MOLEX MINI FIT JR.

The Molex Mini Fit Jr. connectors are used for all of the inputs and the low amperage outputs. They require special tools to service and replace them. See the “Electrical System” Section 12 for serving information.

AMP TERMINALS

The AMP terminals are specially designed terminals capable of handling high amperage connections. These are used on the high amp outputs on the V.3 controls. See the “Electrical System” Section 12 for serving information.

BINDING POST TERMINALS

Binding post terminals offer the best connection available and are used for the main battery terminals on both the V.3 & V.4 controllers. On the V.4 controllers the high output connections have been changed to the binding post type.

TIMED CIRCUITS

The controller has the capability to control a circuit with a certain amount of logic. We can customize the operation of a component beyond the simple on off operation. Timers are used for our vacuum motors and our squeegee actuators to make the machine operation more user friendly. The timer settings are changed through the controller programming.

BATTERY METER

The battery meter is integrated into the controller and the status of the battery is displayed on the LCD screen. The battery condition is monitored very differently from a traditional battery meter. The battery condition is calculated by measuring the internal resistance of the battery pack. The battery meter is designed to read properly when the battery is under load. It is not uncommon for the battery gauge to climb when the machine is under load.

DOWN PRESSURE CONTROL

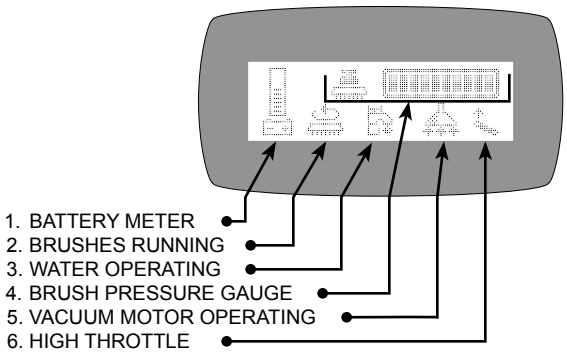
The down pressure of the scrub deck is monitored and maintained by the controller. It is adjusted many times a second to deliver consistent brush pressure with changing floor conditions. The controller monitors the amp draw of the scrub motors which increases and decreases with brush deck pressure and floor surface change. The amp draw has a target value and the controller works to keep the motors at the selected amp draw by increasing or decreasing brush pressure. The target pressure is represented on the LCD display and changed using the brush pressure switch on the control panel.

LCD DISPLAY

The LCD display is a multi function display that conveys machine information to the operator about the operation state of the machine and diagnostic information in the event of a malfunction. The LCD display communicates to the controller on a serial data connection that is made via the 6 wire connector running from the display to the controller. The LCD display has 4 different screens with different information presented on each.

SCREEN 1

Screen 1 is the default screen that appears after the machine has powered up.



1: BATTERY METER - This meter shows the charge level of the batteries in the machine. This gauge is designed to read properly while the machine is in use and therefore will vary during usage of the machine.

2: BRUSHES RUNNING - This icon shows when the controller receives an input to run the scrub brushes.

3: SOLUTION DISPENSING - This icon indicates that the controller is receiving an input to dispense water. The icon flashes in relationship to the amount of time the valve is on for. This is controlled by the solution potentiometer on the control panel.

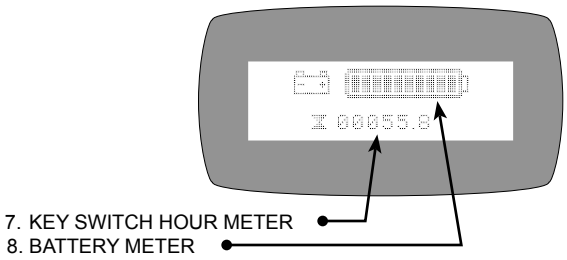
4: BRUSH PRESSURE GAUGE - This icon is a bar graph representation of the desired brush pressure. It is divided into 5 segments and each segment indicates more pad pressure.

5: VACUUM MOTOR - This icon indicates the controller is receiving an input to run the vacuum motor.

6: HIGH THROTTLE - This icon indicates one or more throttle inputs, such as the green handle bar buttons or the reverse switch, were activated when the machine was powered on. Make sure no buttons or switches are depressed and cycle the power to the machine.

SCREEN 2

To access screen 2, push the green page button on the control panel once.



7: KEY SWITCH HOUR METER
This hour meter represents the total number of hours the machine has been powered on. This does not mean however that the machine has been used this long just that it has had the power on for the time indicated.

8: BATTERY METER
This meter shows the charge level of the batteries in the machine. This gauge is designed to read properly while the machine is in use and therefore will vary during usage of the machine.

SCREEN 3

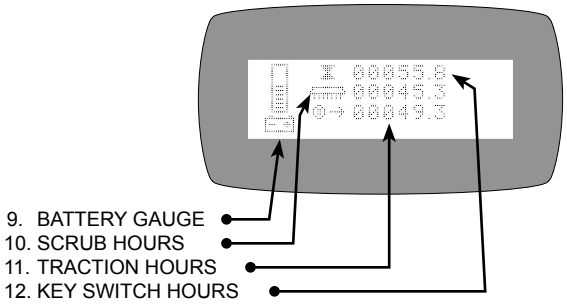
To access this from screen 1 press the green page button twice.

9: BATTERY METER - This meter shows the charge level of the batteries in the machine. This gauge is designed to read properly while the machine is in use and therefore will vary during usage of the machine.

10: SCRUB HOURS - The hour total listed here indicates the total number of hours the brush deck has been operated on the machine.

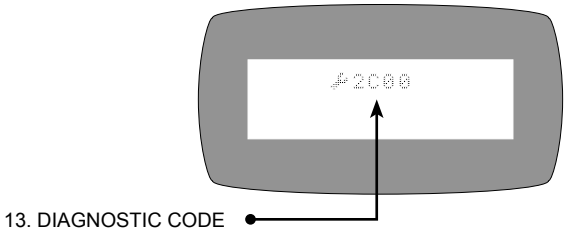
11: TRACTION HOURS - The hour total listed here indicates the total number of hours the traction drive has been operated on the machine.

12: KEY SWITCH HOUR METER - This hour meter represents the total number of hours the machine has been powered on. This does not mean however that the machine has been used this long just that it has had the power on for the time indicated.



SCREEN 4

This screen will appear automatically in the event of a fault being present in the machine. Machine operation will be suspended until the cause of the code is remedied.



ON BOARD DIAGNOSTICS

The Central Command II control system utilizes a Diagnostic Code system that displays diagnostic codes on the LCD display should a malfunction of the machine occur. The diagnostic code can be looked up in the diagnostic code chart and it will assist you in determining the cause of malfunction.

DIAGNOSING THE CONTROL SYSTEM

The Central Command II system with all its robust capabilities is also very easy to diagnose and repair. To diagnose the system a clamp type DC amp meter and high impedance DC Volt meter are required. The machine's LCD display will also be utilized. It is important never to use jumper wires connected to battery power or ground for testing as this can instantly destroy the controller.

The controller is not field serviceable in any way and needs to be replaced in the event of failure.

METERS

It is important to use a high quality meter when diagnosing the control systems on our equipment as a low quality meter can ruin a controller just by taking a measurement. A good rule of thumb is if you didn't pay at least $50 for your meter don't use it on our equipment. NEVER use analog meters for diagnosing the controller systems on our machines as they WILL damage the machine. A DC amp clamp is imperative for diagnosis of the control systems, most DC amp clamps have a built in DC volt meter too. In addition to your meter(s) you should have a quality set of test leads that have alligator clamps on the ends.

MEASUREMENTS

When measuring for voltage in the control system unless otherwise specified you will always set your meter to the DC volts scale and connect your negative (-) test lead to the negative (-) battery cable or buss bar. When measuring for amp draw you will always measure around ONLY 1 wire (+) OR (-) going to the device in question. Place the meter clamp on the wire with power off to the device. Zero out the meter and then power up the device and take your readings.

LCD DISPLAY

The LCD is a critical component and can cause the machine to operate improperly or not operate at all, There is a computer data link that is established between the LCD and the computer when the machine is powered on and all the computer information is routed in a loop through the LCD display. For this reason if an LCD fails it can cause a variety of results from making the machine not turn on to making it not turn off.

INPUTS

The switches in the Central Command II System receive reference voltages from the controller and then send signals, in the form of low or high voltage, to the controller. The controller interprets these signals and then the computer and it's program inside the controller

decide what device there is a request for and how it should operate the device.

TRI-STATE LOGIC

The Central Command II system uses very low voltage throughout it's control system. This voltage is less than battery voltage and the controller will be destroyed if battery voltage is induced into the control circuits. The tri-state logic uses 3 voltages as follows;

LOW = 0.0 - 0.3 volts
MID = 0.8 - 2.7 volts
HIGH = 4.8 - 5.2 volts

The low and high voltages are reference voltages created by the controller. These voltages are sent to the various controller inputs via the control panel switches. The controller then makes the machine operate a certain way. All inputs at the controller, with the exception of the throttle input, are at a voltage of 0.8 to 2.6 volts when they are at a "neutral" or un-switched state. When a signal is sent to an input via a switch it is either a "LOW" or "HIGH" reference signal. The computer monitors the input terminal many times a second and when the voltage of it changes the computer reacts accordingly to the program in it changing the outputs of the controller.

INPUTS- VARIABLE VOLTAGE

It addition to the standard tri-state logic inputs the controller also used varied voltage inputs. Examples of these inputs would be the throttle and the solution circuit. On these inputs the a high and low signal are fed to a 5K potentiometer on each of the outside terminals. The voltage is summed by the potentiometer and the summed voltage is sent out the center terminal of the potentiometer to the input terminal on the controller. As the potentiometer is rotated the center wiper contact inside increases or decreases it's distance from the high reference signal creating a sweeping voltage from about 0.0 volts to 5.1 volts. This sweeping voltage is interpreted by the controller and the outputs are then controlled according to the program.

OUTPUTS

The outputs of the controller are controlled by the embedded computer and it's program. It iterprets the inputs and energizes the out puts accordingly. The outputs on the controller are driven by transistors and not relays so they are different to diagnose than a traditional control system. An important thing to be aware of is when an output is turned off there can be as much of 80% of the voltage present at the output when you measure it with a meter. The voltage that is present comes from the continuity test that the controller continually runs on some of the output circuits. This a very low amp signal that can register on your meter but is not enough amperage to power a motor or other accessory. To consider an output to be "on" or activated it must be 95% of battery voltage.

SOLUTION SOLENOID: AUX 3

The solution solenoid output of the controller provides a ground to the solution solenoid valve. The positive voltage feed to the solenoid valve comes from the switched B+ power from the controller on pin #8 of the 14 pin Molex connector at the controller.

PROGRAMMING

We use the same controllers on nearly all of our machines. The controller's embedded computer needs a set of instructions to operate the machine. The instructions are the program the computer runs and we can modify this program by changing it's "parameters". This is what makes it possible to use the same controller in most of our machines but have each one of them react differently. By changing these parameters we can make the piece of equipment function in different ways. An example of this is by changing the parameters we can make brush deck of a machine drop to the floor when the machine starts scrubbing and then pick itself up when the machine stops. If we adjusted another parameter we could make the brushes raise up when the machine went in reverse without having the operator manipulate a switch. In order to change the parameters in a controller a T-194 programing kit is necessary. With a laptop computer and the programming kit access can be gained to the parameters of the machine and they can be modified to make the machine react differently.

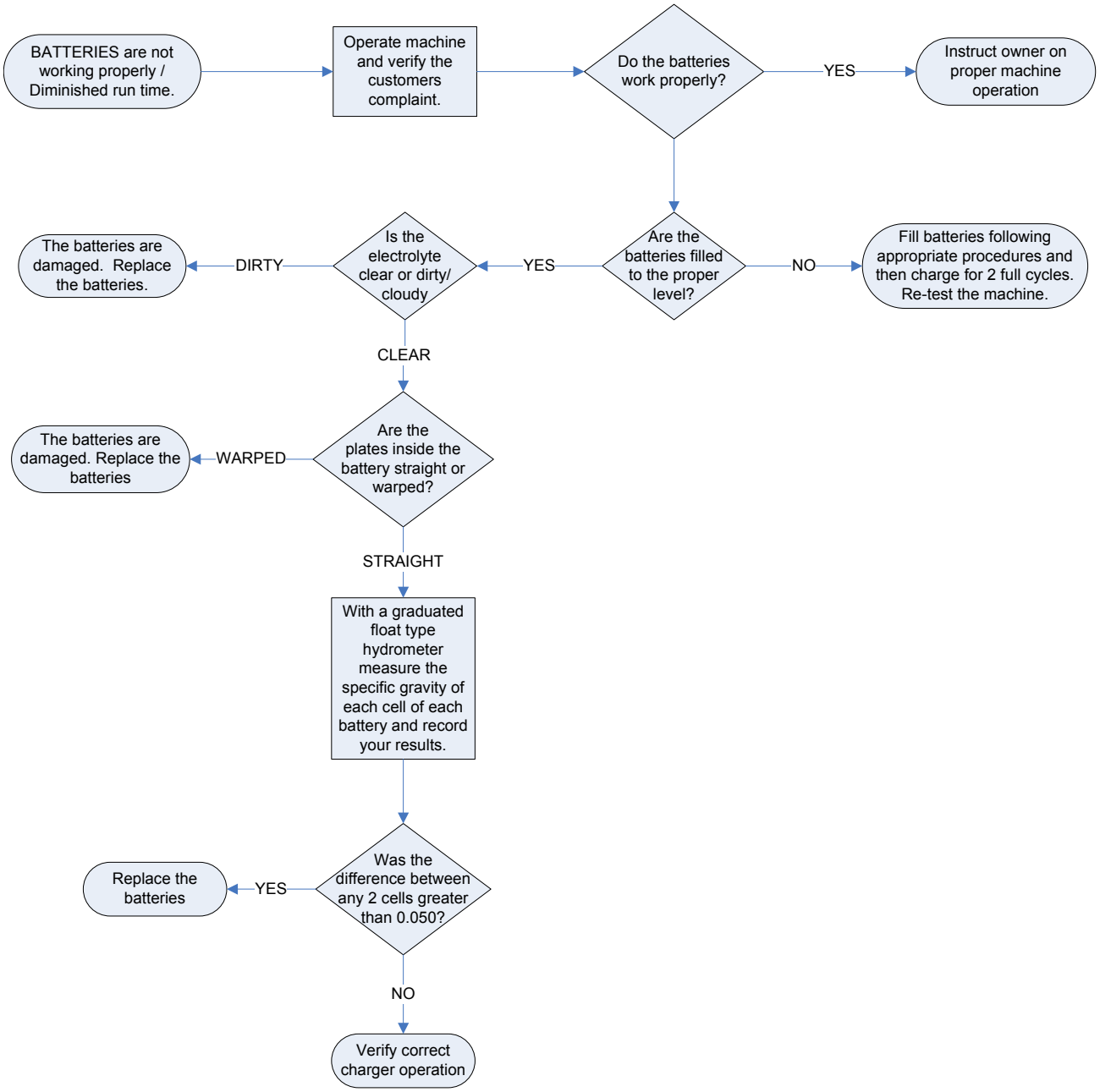
The controller has 135 parameters that can be modified through programming. To program the controller a programming kit and special software are necessary. The kit for this is available from the factory. The part number for the kit is T-194 and it includes the following:

1	Central Command II Programmer CD
1	Controller computer interface cable
1	USB serial port adapter
1	Controller protected power cable
1	Jumper key
1	Latest version of the Electrical Service Guide
1	T-194 programming guide
1	Aluminum briefcase

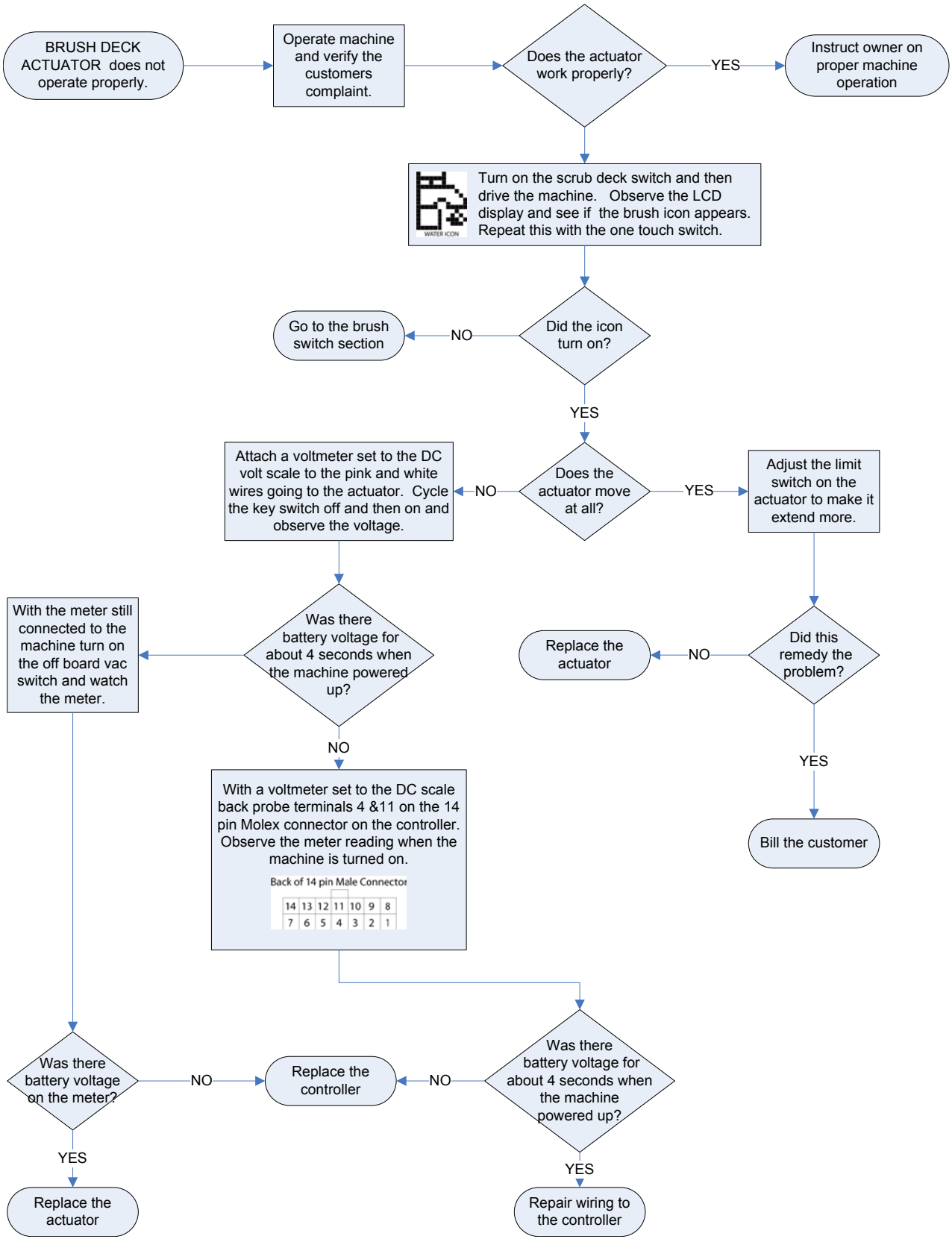
INSERT T-194 KIT PICTURE HERE

This kit is required to make any changes in the program for the computer.

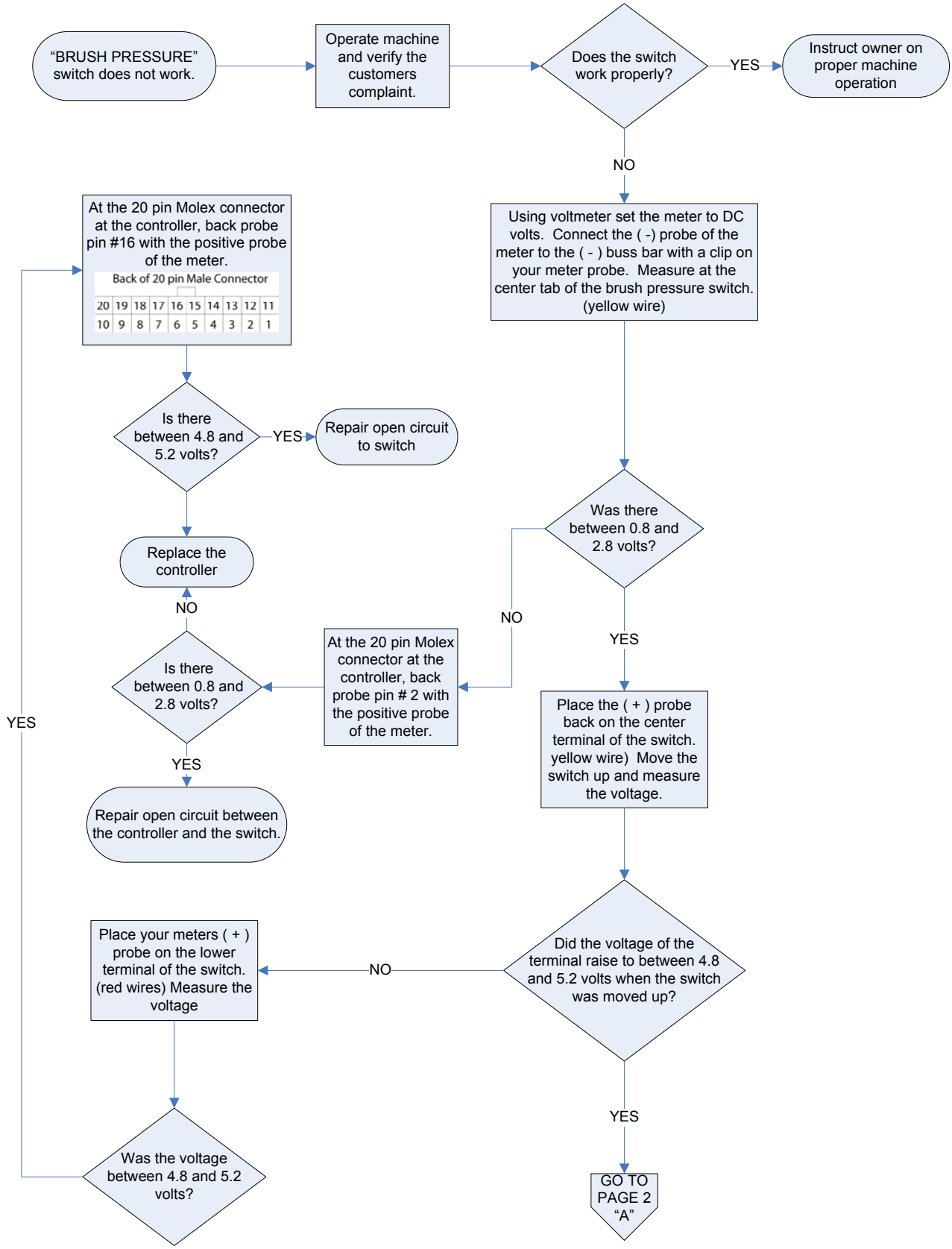
MAGNUM BATTERY DIAGNOSTIC FLOW CHART
1 of 1


BATTERIES are not working properly / Diminished run time.
Operate machine and verify the customers complaint.
Do the batteries work properly?
YES
Instruct owner on proper machine operation
Are the batteries filled to the proper level?
NO
Fill batteries following appropriate procedures and then charge for 2 full cycles. Re-test the machine.
YES
Is the electrolyte clear or dirty/ cloudy
DIRTY
The batteries are damaged. Replace the batteries.
CLEAR
Are the plates inside the battery straight or warped?
WARPED
The batteries are damaged. Replace the batteries
STRAIGHT
With a graduated float type hydrometer measure the specific gravity of each cell of each battery and record your results.
Was the difference between any 2 cells greater than 0.050?
YES
Replace the batteries
NO
Verify correct charger operation

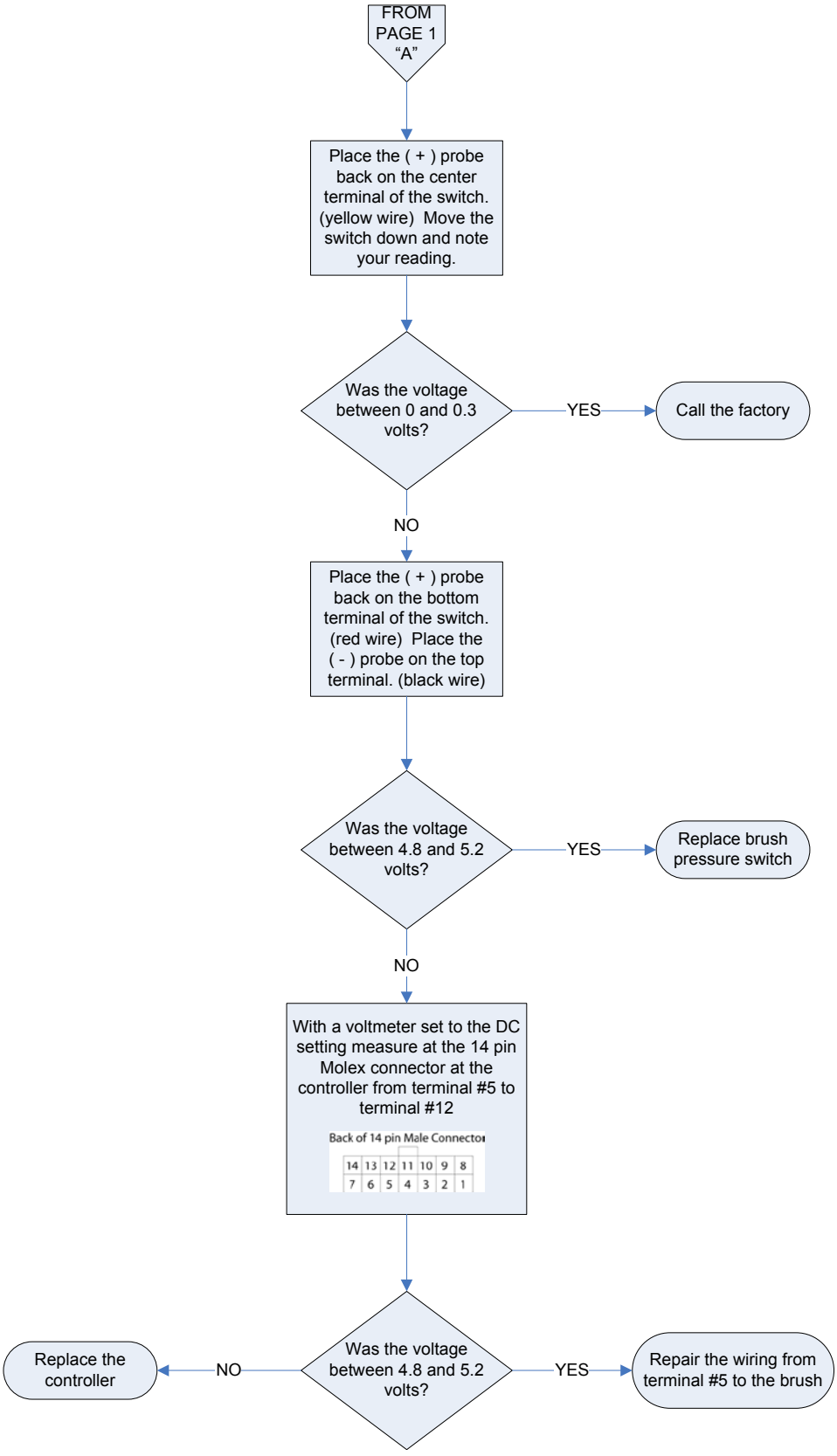
MAGNUM BRUSH DECK ACTUATOR DIAGNOSTIC FLOW CHART
1 of 1


BRUSH DECK ACTUATOR does not operate properly.
Operate machine and verify the customers complaint.
Does the actuator work properly?
YES
Instruct owner on proper machine operation
Turn on the scrub deck switch and then drive the machine. Observe the LCD display and see if the brush icon appears. Repeat this with the one touch switch.
Did the icon turn on?
NO
Go to the brush switch section
YES
Does the actuator move at all?
NO
Attach a voltmeter set to the DC volt scale to the pink and white wires going to the actuator. Cycle the key switch off and then on and observe the voltage.
YES
Adjust the limit switch on the actuator to make it extend more.
Was there battery voltage for about 4 seconds when the machine powered up?
With the meter still connected to the machine turn on the off board vac switch and watch the meter.
NO
With a voltmeter set to the DC scale back probe terminals 4 &11 on the 14 pin Molex connector on the controller. Observe the meter reading when the machine is turned on.
Back of 14 pin Male Connector
14 13 12 11 10 9 8
7 6 5 4 3 2 1
Did this remedy the problem?
NO
Replace the actuator
YES
Bill the customer
Was there battery voltage on the meter?
NO
Replace the controller
NO
Was there battery voltage for about 4 seconds when the machine powered up?
YES
Replace the actuator
YES
Repair wiring to the controller

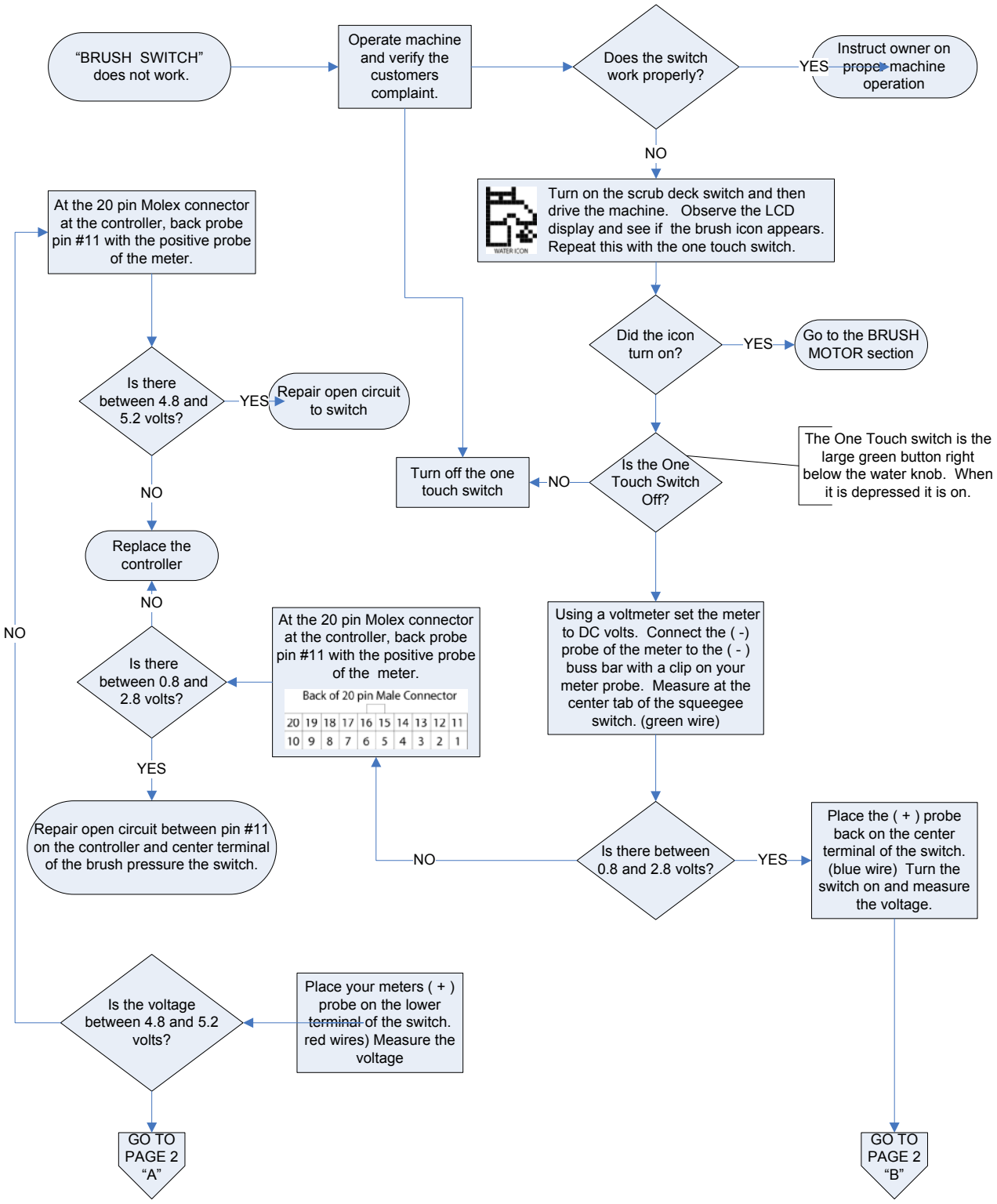
MAGNUM BRUSH PRESSURE SWITCH DIAGNOSTIC FLOW CHART
1 of 2


"BRUSH PRESSURE" switch does not work.
Operate machine and verify the customers complaint.
Does the switch work properly?
YES
Instruct owner on proper machine operation
NO
Using voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. Measure at the center tab of the brush pressure switch. (yellow wire)
Was there between 0.8 and 2.8 volts?
NO
YES
Place the (+) probe back on the center terminal of the switch. yellow wire) Move the switch up and measure the voltage.
Did the voltage of the terminal raise to between 4.8 and 5.2 volts when the switch was moved up?
NO
Place your meters (+) probe on the lower terminal of the switch. (red wires) Measure the voltage
Was the voltage between 4.8 and 5.2 volts?
YES
GO TO PAGE 2 "A"
YES
At the 20 pin Molex connector at the controller, back probe pin #16 with the positive probe of the meter.
Back of 20 pin Male Connector
20 19 18 17 16 15 14 13 12 11
10 9 8 7 6 5 4 3 2 1
Is there between 4.8 and 5.2 volts?
YES
Repair open circuit to switch
Replace the controller
NO
Is there between 0.8 and 2.8 volts?
YES
Repair open circuit between the controller and the switch.
At the 20 pin Molex connector at the controller, back probe pin # 2 with the positive probe of the meter.

MAGNUM BRUSH PRESSURE SWITCH DIAGNOSTIC FLOW CHART
2 of 2


FROM PAGE 1 "A"
Place the (+) probe back on the center terminal of the switch. (yellow wire) Move the switch down and note your reading.
Was the voltage between 0 and 0.3 volts?
YES
Call the factory
NO
Place the (+) probe back on the bottom terminal of the switch. (red wire) Place the (-) probe on the top terminal. (black wire)
Was the voltage between 4.8 and 5.2 volts?
YES
Replace brush pressure switch
NO
With a voltmeter set to the DC setting measure at the 14 pin Molex connector at the controller from terminal #5 to terminal #12
Back of 14 pin Male Connector
14 13 12 11 10 9 8
7 6 5 4 3 2 1
Was the voltage between 4.8 and 5.2 volts?
NO
Replace the controller
YES
Repair the wiring from terminal #5 to the brush

MAGNUM BRUSH SWITCH DIAGNOSTIC FLOW CHART
1 of 2


"BRUSH SWITCH" does not work.
Operate machine and verify the customers complaint.
Does the switch work properly?
YES
Instruct owner on proper machine operation
NO
Turn on the scrub deck switch and then drive the machine. Observe the LCD display and see if the brush icon appears. Repeat this with the one touch switch.
Did the icon turn on?
YES
Go to the BRUSH MOTOR section
Is the One Touch Switch Off?
The One Touch switch is the large green button right below the water knob. When it is depressed it is on.
NO
Turn off the one touch switch
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. Measure at the center tab of the squeegee switch. (green wire)
Is there between 0.8 and 2.8 volts?
YES
Place the (+) probe back on the center terminal of the switch. (blue wire) Turn the switch on and measure the voltage.
NO
At the 20 pin Molex connector at the controller, back probe pin #11 with the positive probe of the meter.
Back of 20 pin Male Connector
20 19 18 17 16 15 14 13 12 11
10 9 8 7 6 5 4 3 2 1
Is there between 0.8 and 2.8 volts?
YES
Repair open circuit between pin #11 on the controller and center terminal of the brush pressure the switch.
NO
Replace the controller
NO
At the 20 pin Molex connector at the controller, back probe pin #11 with the positive probe of the meter.
Is there between 4.8 and 5.2 volts?
YES
Repair open circuit to switch
NO
Place your meters (+) probe on the lower terminal of the switch. red wires) Measure the voltage
Is the voltage between 4.8 and 5.2 volts?
NO
GO TO PAGE 2 "A"
GO TO PAGE 2 "B"

MAGNUM BRUSH SWITCH DIAGNOSTIC FLOW CHART
2 of 2

FROM PAGE 1 "A"

YES

Replace the brush pressure switch

YES

Is the voltage between 4.8 and 5.2 volts?

NO

With a voltmeter set to the DC scale measure from the #12 terminal on the 14 pin Molex connector on the controller to the negative buss bar.

Back of 14 pin Male Connector

14	13	12	11	10	9	8
7	6	5	4	3	2	1

Is the voltage between 4.8 and 5.2 volts?

NO

Replace the controller

YES

Repaiur connection between terminal #12 of the 14 pin molex connector and the rear terminal on the brush deck switch

With a voltmeter set to the DC volt scale measure from the negative buss bar to the rear terminal of the brush pressure switch

NO

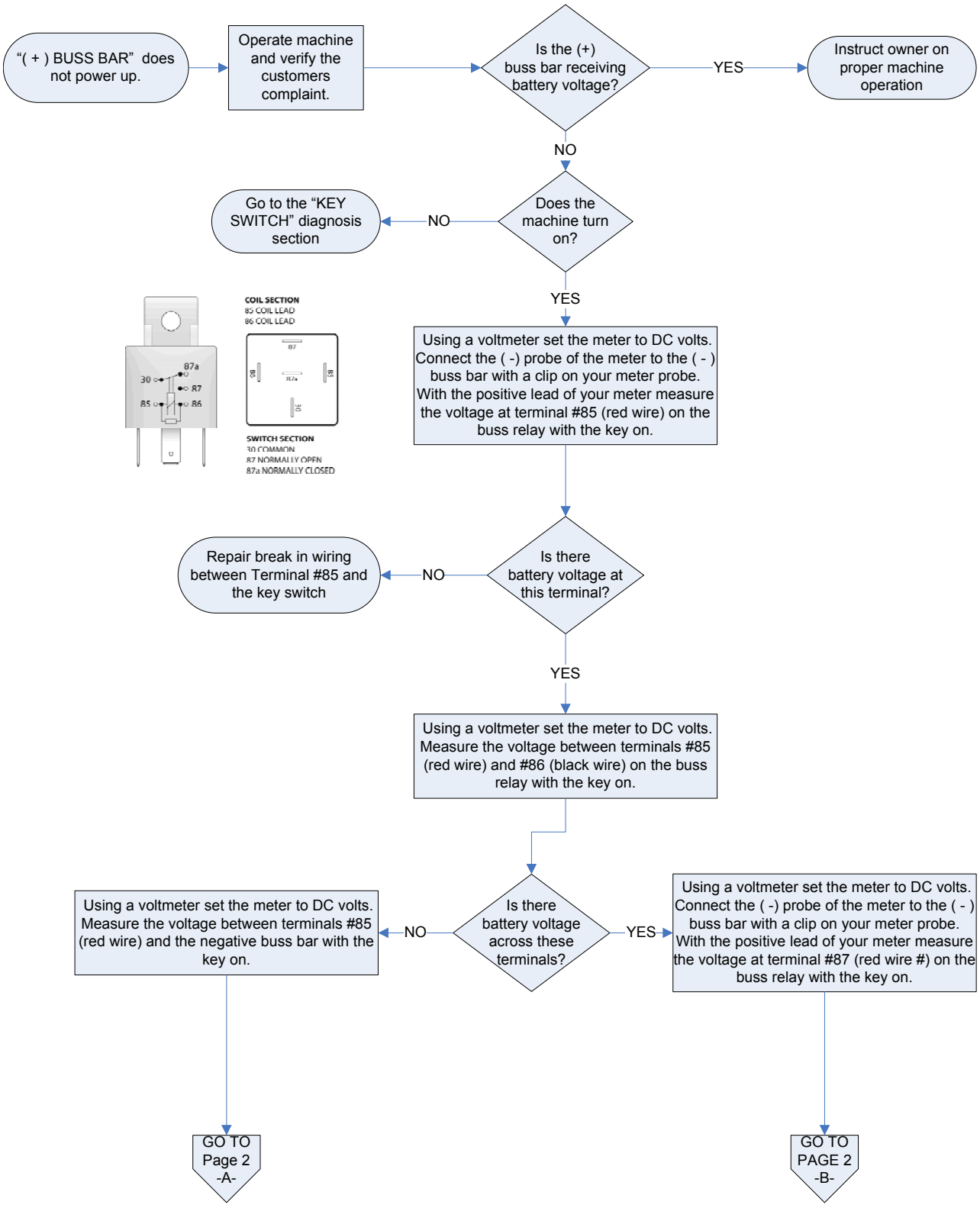
Did the voltage of the terminal raise to between 4.8 and 5.2 volts when the switch was moved up?

YES

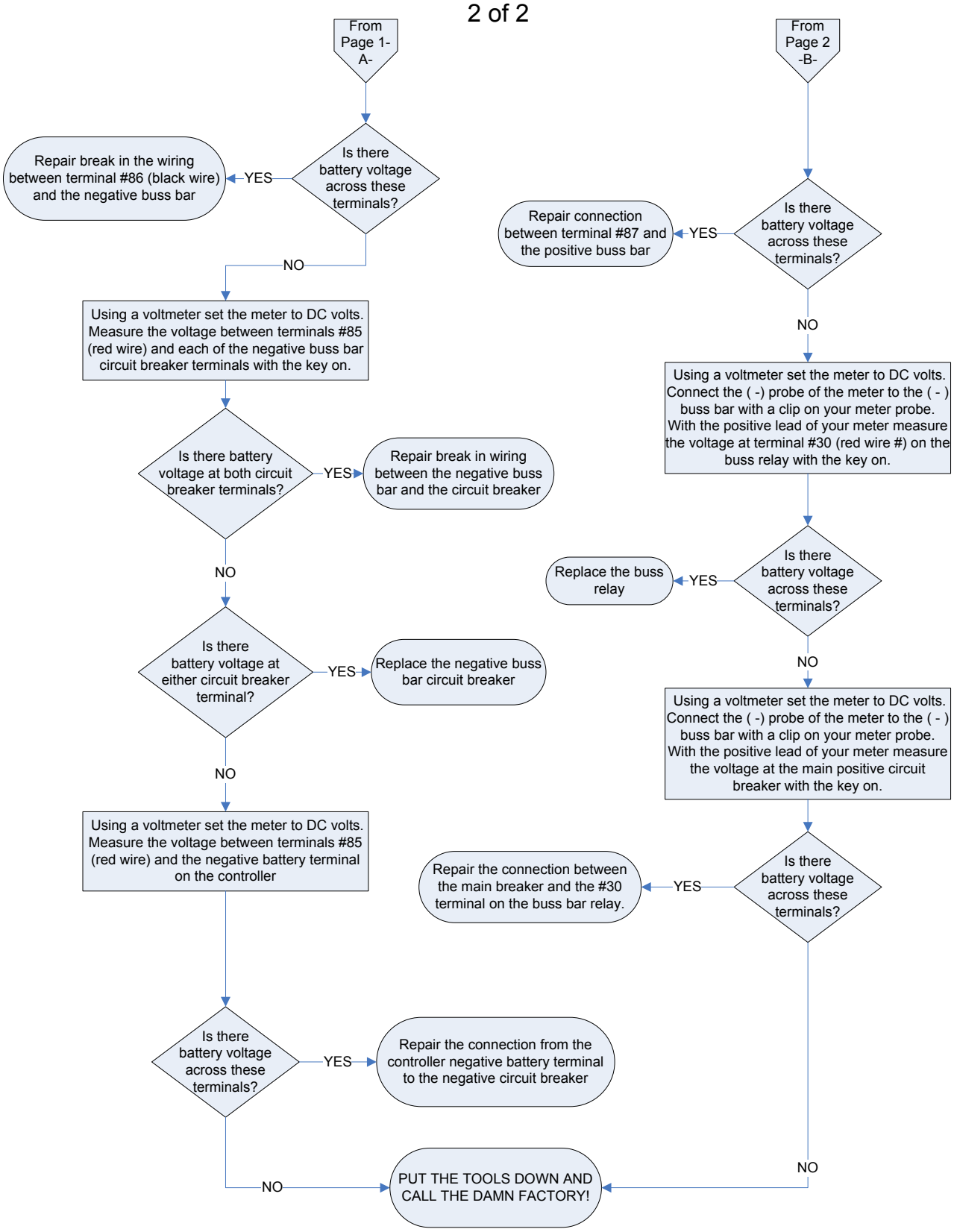
Call the factory

FROM PAGE 1 "B"

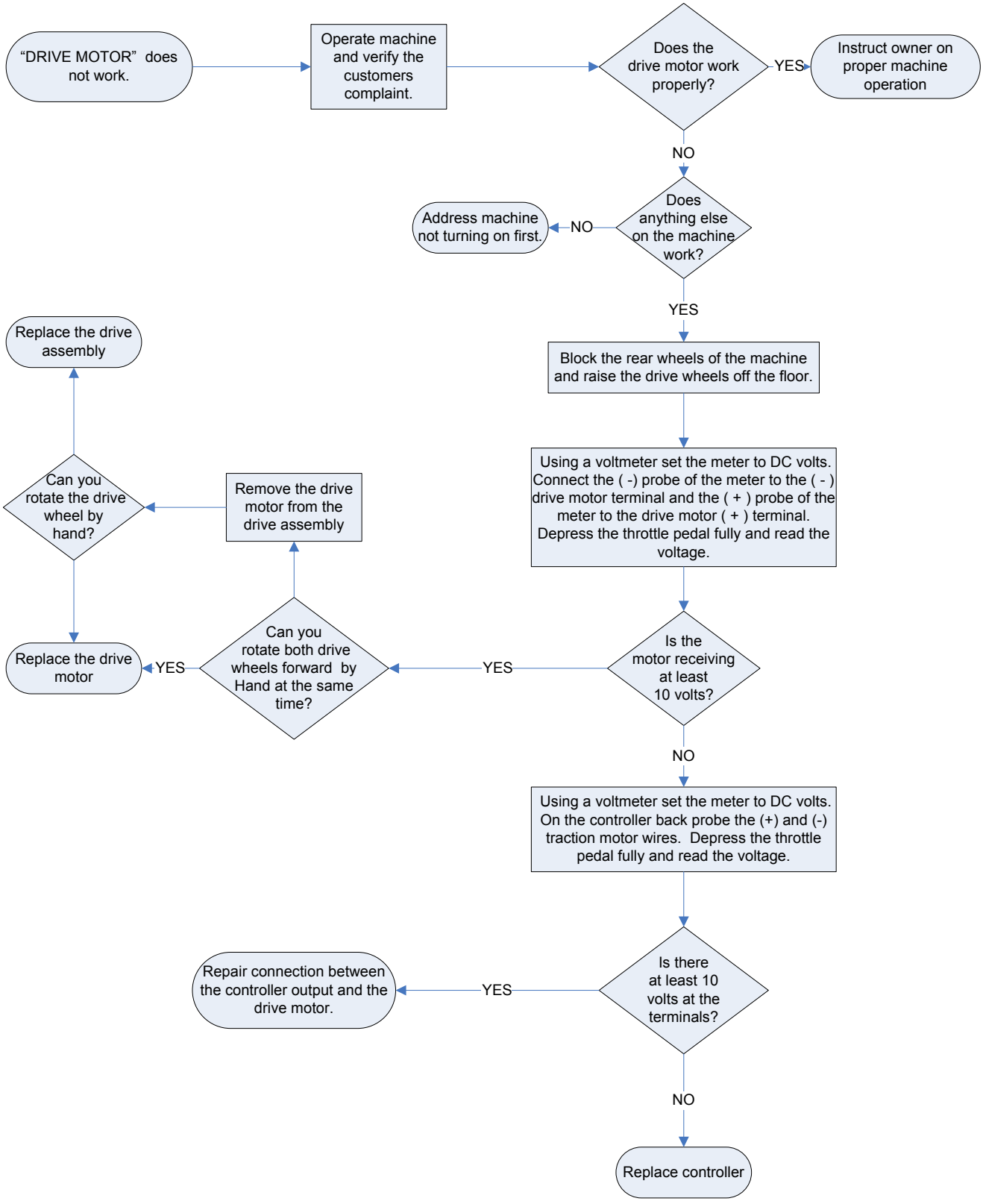
MAGNUM BUSS RELAY DIAGNOSTIC FLOW CHART
1 of 2


"(+) BUSS BAR" does not power up.
Operate machine and verify the customers complaint.
Is the (+) buss bar receiving battery voltage?
YES
Instruct owner on proper machine operation
NO
Does the machine turn on?
NO
Go to the "KEY SWITCH" diagnosis section
YES
COIL SECTION
85 COIL LEAD
86 COIL LEAD
87a
30
87
85
86
SWITCH SECTION
30 COMMON
87 NORMALLY OPEN
87a NORMALLY CLOSED
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. With the positive lead of your meter measure the voltage at terminal #85 (red wire) on the buss relay with the key on.
Is there battery voltage at this terminal?
NO
Repair break in wiring between Terminal #85 and the key switch
YES
Using a voltmeter set the meter to DC volts. Measure the voltage between terminals #85 (red wire) and #86 (black wire) on the buss relay with the key on.
Is there battery voltage across these terminals?
NO
Using a voltmeter set the meter to DC volts. Measure the voltage between terminals #85 (red wire) and the negative buss bar with the key on.
YES
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. With the positive lead of your meter measure the voltage at terminal #87 (red wire #) on the buss relay with the key on.
GO TO Page 2 -A-
GO TO PAGE 2 -B-

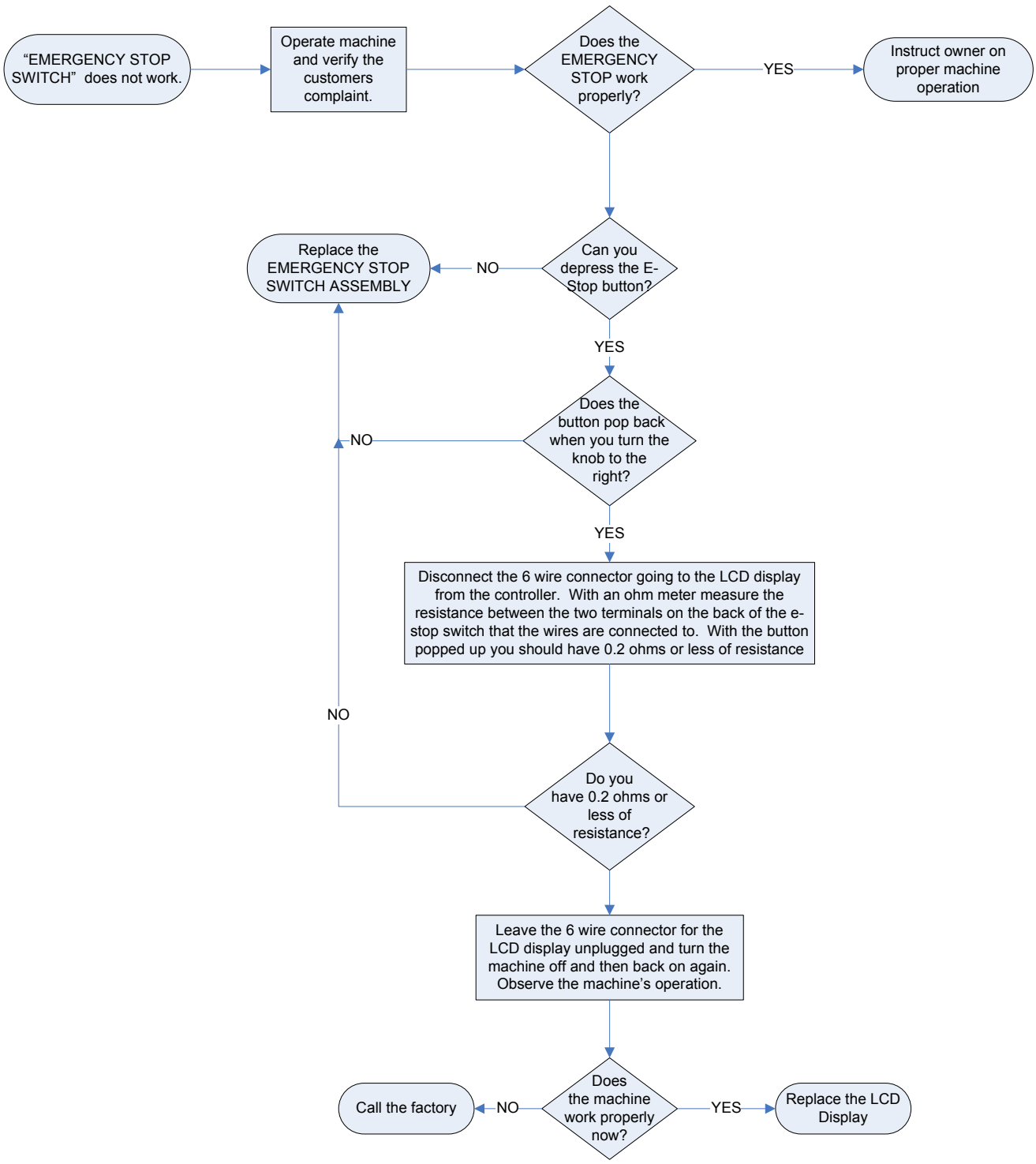
MAGNUM BUSS RELAY DIAGNOSTIC FLOW CHART
2 of 2


From Page 1- A-
Is there battery voltage across these terminals?
YES
Repair break in the wiring between terminal #86 (black wire) and the negative buss bar
NO
Using a voltmeter set the meter to DC volts. Measure the voltage between terminals #85 (red wire) and each of the negative buss bar circuit breaker terminals with the key on.
Is there battery voltage at both circuit breaker terminals?
YES
Repair break in wiring between the negative buss bar and the circuit breaker
NO
Is there battery voltage at either circuit breaker terminal?
YES
Replace the negative buss bar circuit breaker
NO
Using a voltmeter set the meter to DC volts. Measure the voltage between terminals #85 (red wire) and the negative battery terminal on the controller
Is there battery voltage across these terminals?
YES
Repair the connection from the controller negative battery terminal to the negative circuit breaker
NO
PUT THE TOOLS DOWN AND CALL THE DAMN FACTORY!
From Page 2 -B-
Is there battery voltage across these terminals?
YES
Repair connection between terminal #87 and the positive buss bar
NO
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. With the positive lead of your meter measure the voltage at terminal #30 (red wire #) on the buss relay with the key on.
Is there battery voltage across these terminals?
YES
Replace the buss relay
NO
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar with a clip on your meter probe. With the positive lead of your meter measure the voltage at the main positive circuit breaker with the key on.
Is there battery voltage across these terminals?
YES
Repair the connection between the main breaker and the #30 terminal on the buss bar relay.
NO

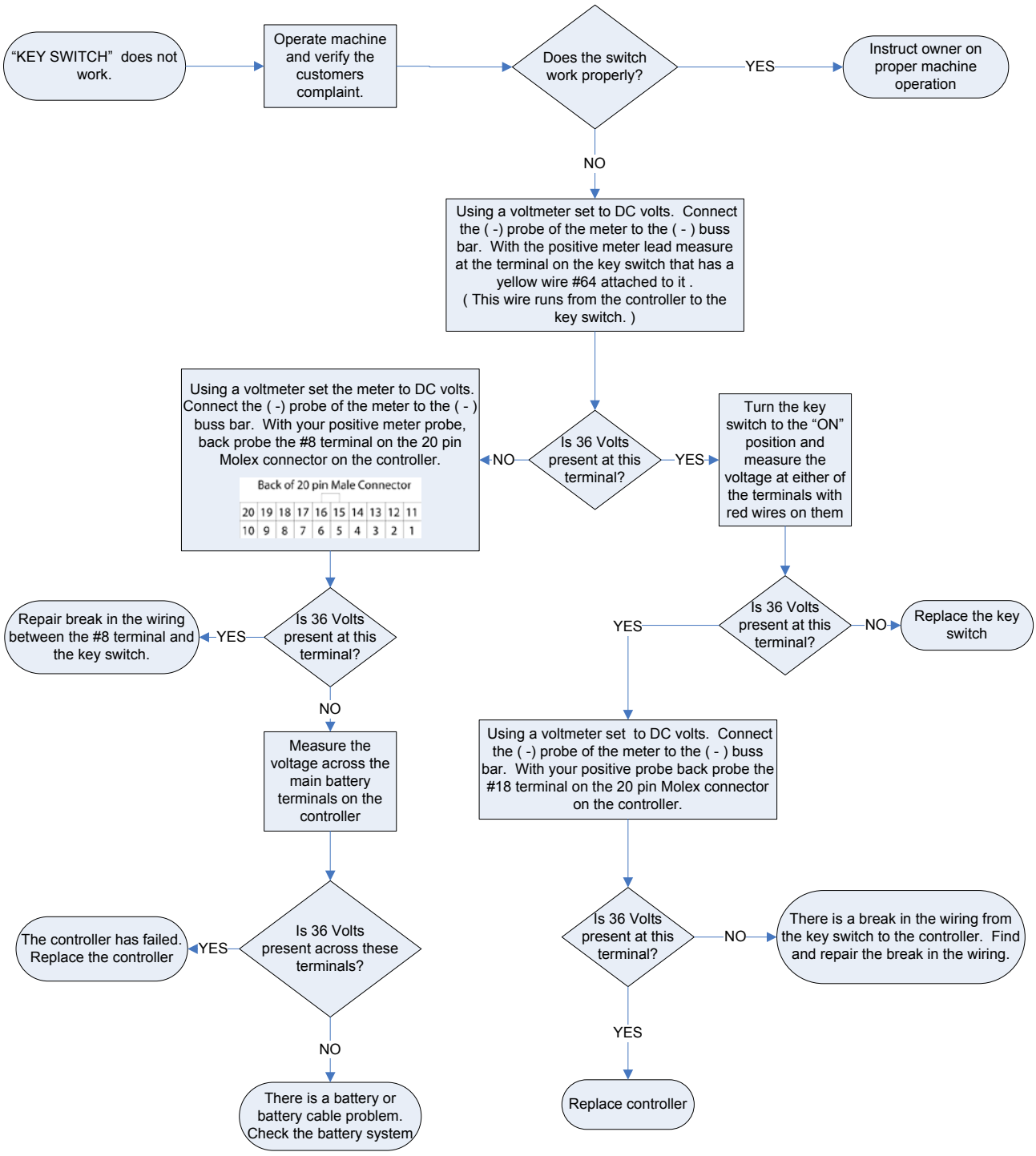
MAGNUM DRIVE MOTOR DIAGNOSTIC FLOW CHART
1 of 1


"DRIVE MOTOR" does not work.
Operate machine and verify the customers complaint.
Does the drive motor work properly?
YES
Instruct owner on proper machine operation
NO
Does anything else on the machine work?
NO
Address machine not turning on first.
YES
Block the rear wheels of the machine and raise the drive wheels off the floor.
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) drive motor terminal and the (+) probe of the meter to the drive motor (+) terminal. Depress the throttle pedal fully and read the voltage.
Is the motor receiving at least 10 volts?
YES
Can you rotate both drive wheels forward by Hand at the same time?
YES
Replace the drive motor
Remove the drive motor from the drive assembly
Can you rotate the drive wheel by hand?
Replace the drive assembly
NO
Using a voltmeter set the meter to DC volts. On the controller back probe the (+) and (-) traction motor wires. Depress the throttle pedal fully and read the voltage.
Is there at least 10 volts at the terminals?
YES
Repair connection between the controller output and the drive motor.
NO
Replace controller

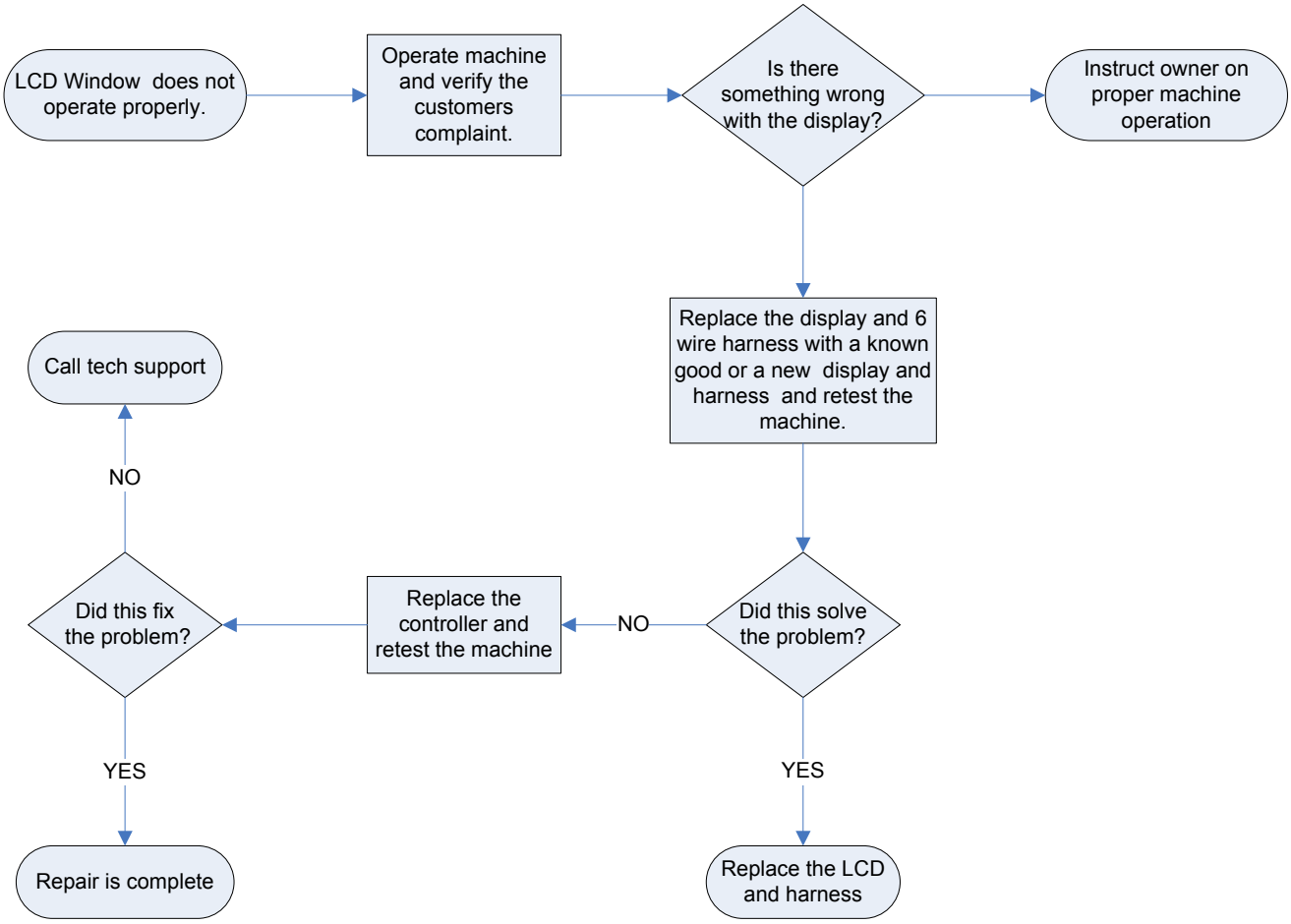
MAGNUM EMERGENCY STOP DIAGNOSTIC FLOW CHART
1 of 1


"EMERGENCY STOP SWITCH" does not work.
Operate machine and verify the customers complaint.
Does the EMERGENCY STOP work properly?
YES
Instruct owner on proper machine operation
Can you depress the E-Stop button?
NO
Replace the EMERGENCY STOP SWITCH ASSEMBLY
YES
Does the button pop back when you turn the knob to the right?
NO
YES
Disconnect the 6 wire connector going to the LCD display from the controller. With an ohm meter measure the resistance between the two terminals on the back of the e-stop switch that the wires are connected to. With the button popped up you should have 0.2 ohms or less of resistance
Do you have 0.2 ohms or less of resistance?
NO
Leave the 6 wire connector for the LCD display unplugged and turn the machine off and then back on again. Observe the machine's operation.
Does the machine work properly now?
NO
Call the factory
YES
Replace the LCD Display

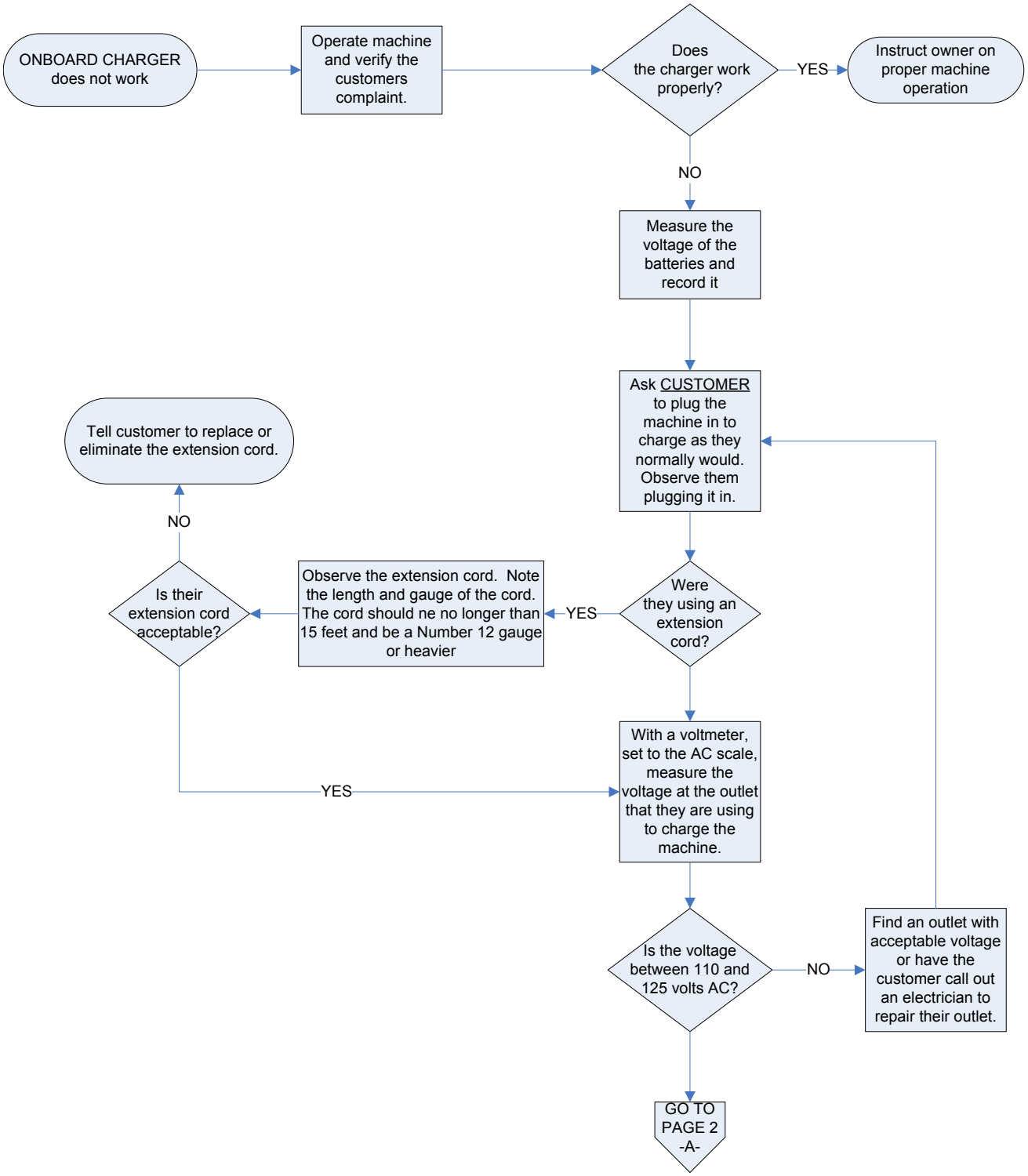
MAGNUM KEY SWITCH DIAGNOSTIC FLOW CHART
1 of 1


"KEY SWITCH" does not work.
Operate machine and verify the customers complaint.
Does the switch work properly?
YES
Instruct owner on proper machine operation
NO
Using a voltmeter set to DC volts. Connect the (-) probe of the meter to the (-) buss bar. With the positive meter lead measure at the terminal on the key switch that has a yellow wire #64 attached to it . (This wire runs from the controller to the key switch.)
Is 36 Volts present at this terminal?
NO
YES
Using a voltmeter set the meter to DC volts. Connect the (-) probe of the meter to the (-) buss bar. With your positive meter probe, back probe the #8 terminal on the 20 pin Molex connector on the controller.
Back of 20 pin Male Connector
20 19 18 17 16 15 14 13 12 11
10 9 8 7 6 5 4 3 2 1
Turn the key switch to the "ON" position and measure the voltage at either of the terminals with red wires on them
Is 36 Volts present at this terminal?
YES
Repair break in the wiring between the #8 terminal and the key switch.
NO
Replace the key switch
Is 36 Volts present at this terminal?
YES
NO
Measure the voltage across the main battery terminals on the controller
Using a voltmeter set to DC volts. Connect the (-) probe of the meter to the (-) buss bar. With your positive probe back probe the #18 terminal on the 20 pin Molex connector on the controller.
Is 36 Volts present across these terminals?
YES
The controller has failed. Replace the controller
NO
There is a battery or battery cable problem. Check the battery system
Is 36 Volts present at this terminal?
NO
There is a break in the wiring from the key switch to the controller. Find and repair the break in the wiring.
YES
Replace controller

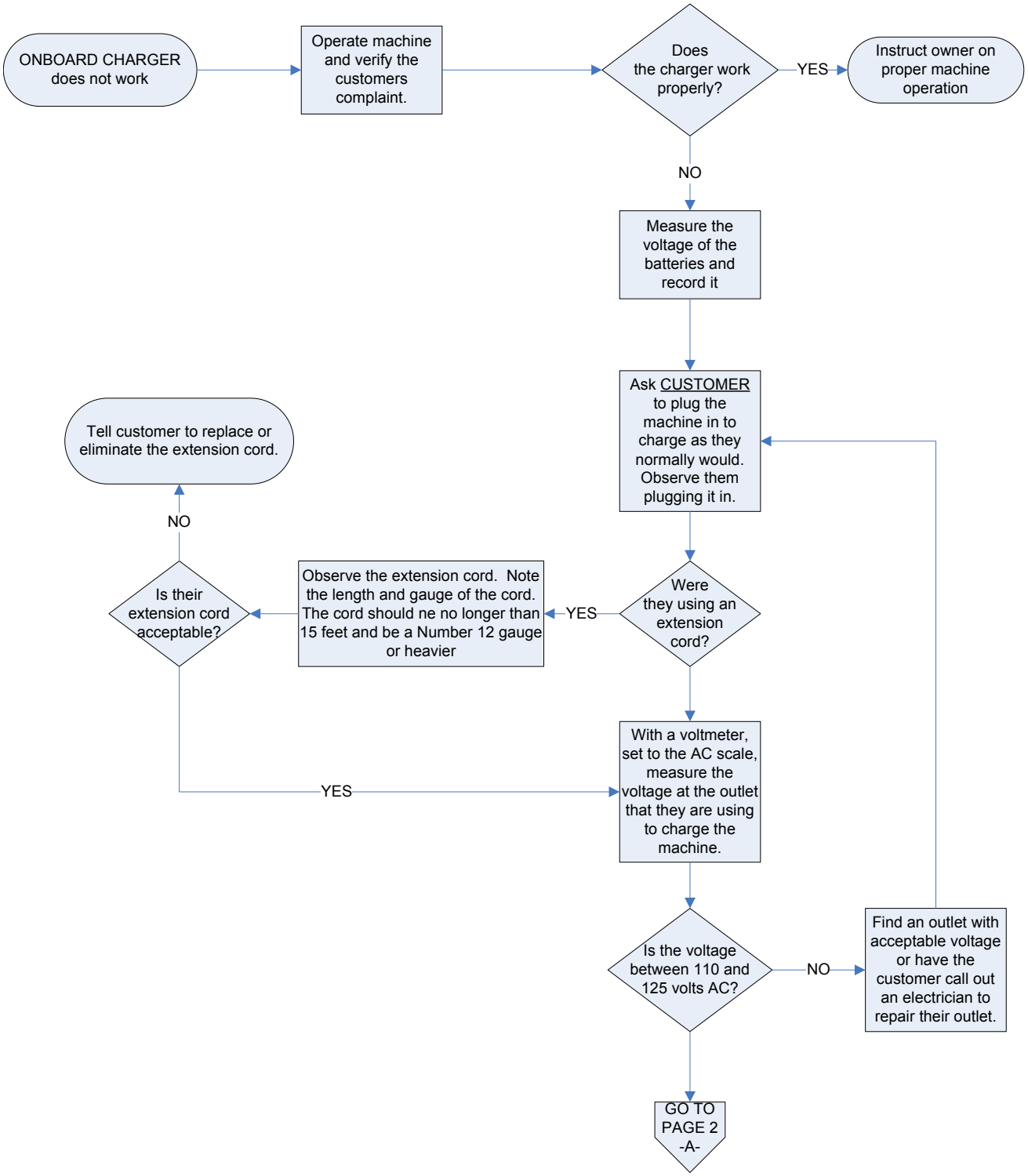
MAGNUM LCD WINDOW DIAGNOSTIC FLOW CHART
1 of 1


LCD Window does not operate properly.
Operate machine and verify the customers complaint.
Is there something wrong with the display?
Instruct owner on proper machine operation
Replace the display and 6 wire harness with a known good or a new display and harness and retest the machine.
Did this solve the problem?
NO
Replace the controller and retest the machine
Did this fix the problem?
NO
Call tech support
YES
Repair is complete
YES
Replace the LCD and harness

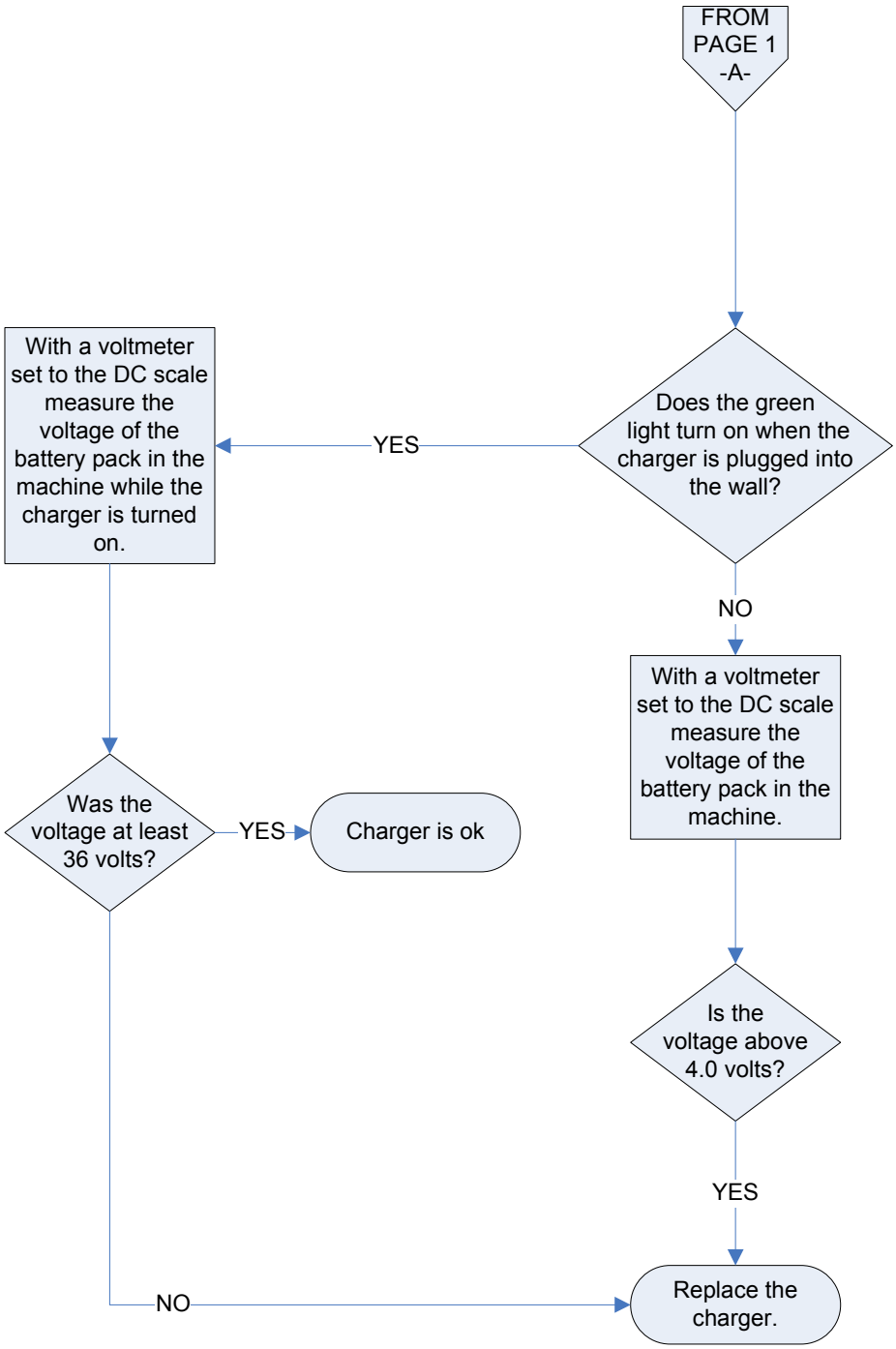
MAGNUM ONBOARD CHARGER DIAGNOSTIC FLOW CHART
1 of 1


ONBOARD CHARGER does not work
Operate machine and verify the customers complaint.
Does the charger work properly?
YES
Instruct owner on proper machine operation
NO
Measure the voltage of the batteries and record it
Ask CUSTOMER to plug the machine in to charge as they normally would. Observe them plugging it in.
Were they using an extension cord?
YES
Observe the extension cord. Note the length and gauge of the cord. The cord should ne no longer than 15 feet and be a Number 12 gauge or heavier
Is their extension cord acceptable?
NO
Tell customer to replace or eliminate the extension cord.
YES
With a voltmeter, set to the AC scale, measure the voltage at the outlet that they are using to charge the machine.
Is the voltage between 110 and 125 volts AC?
NO
Find an outlet with acceptable voltage or have the customer call out an electrician to repair their outlet.
GO TO PAGE 2 -A-

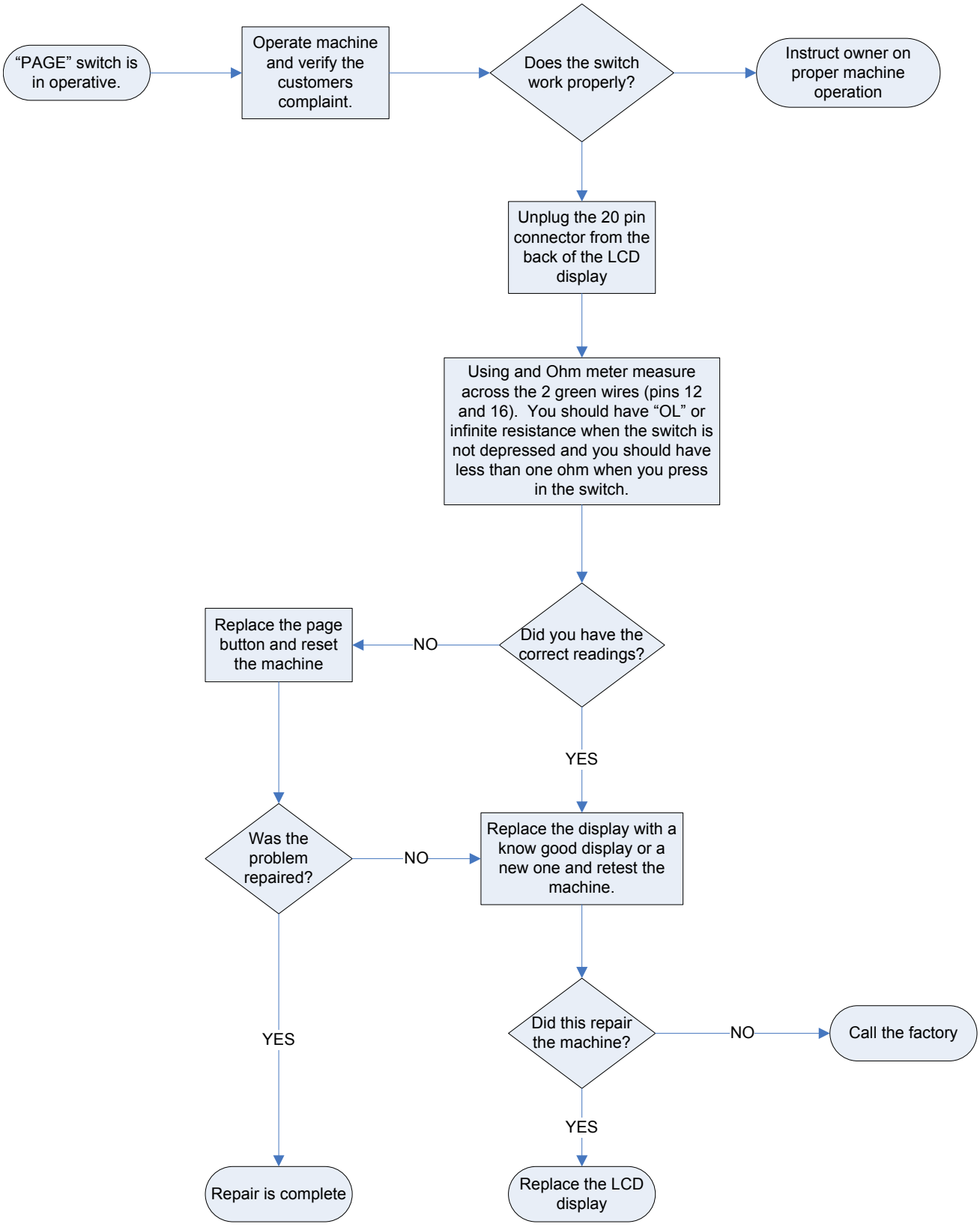
MAGNUM ONBOARD CHARGER DIAGNOSTIC FLOW CHART
1 of 1


ONBOARD CHARGER does not work
Operate machine and verify the customers complaint.
Does the charger work properly?
YES
Instruct owner on proper machine operation
NO
Measure the voltage of the batteries and record it
Ask CUSTOMER to plug the machine in to charge as they normally would. Observe them plugging it in.
Were they using an extension cord?
YES
Observe the extension cord. Note the length and gauge of the cord. The cord should ne no longer than 15 feet and be a Number 12 gauge or heavier
Is their extension cord acceptable?
NO
Tell customer to replace or eliminate the extension cord.
YES
With a voltmeter, set to the AC scale, measure the voltage at the outlet that they are using to charge the machine.
Is the voltage between 110 and 125 volts AC?
NO
Find an outlet with acceptable voltage or have the customer call out an electrician to repair their outlet.
GO TO PAGE 2 -A-

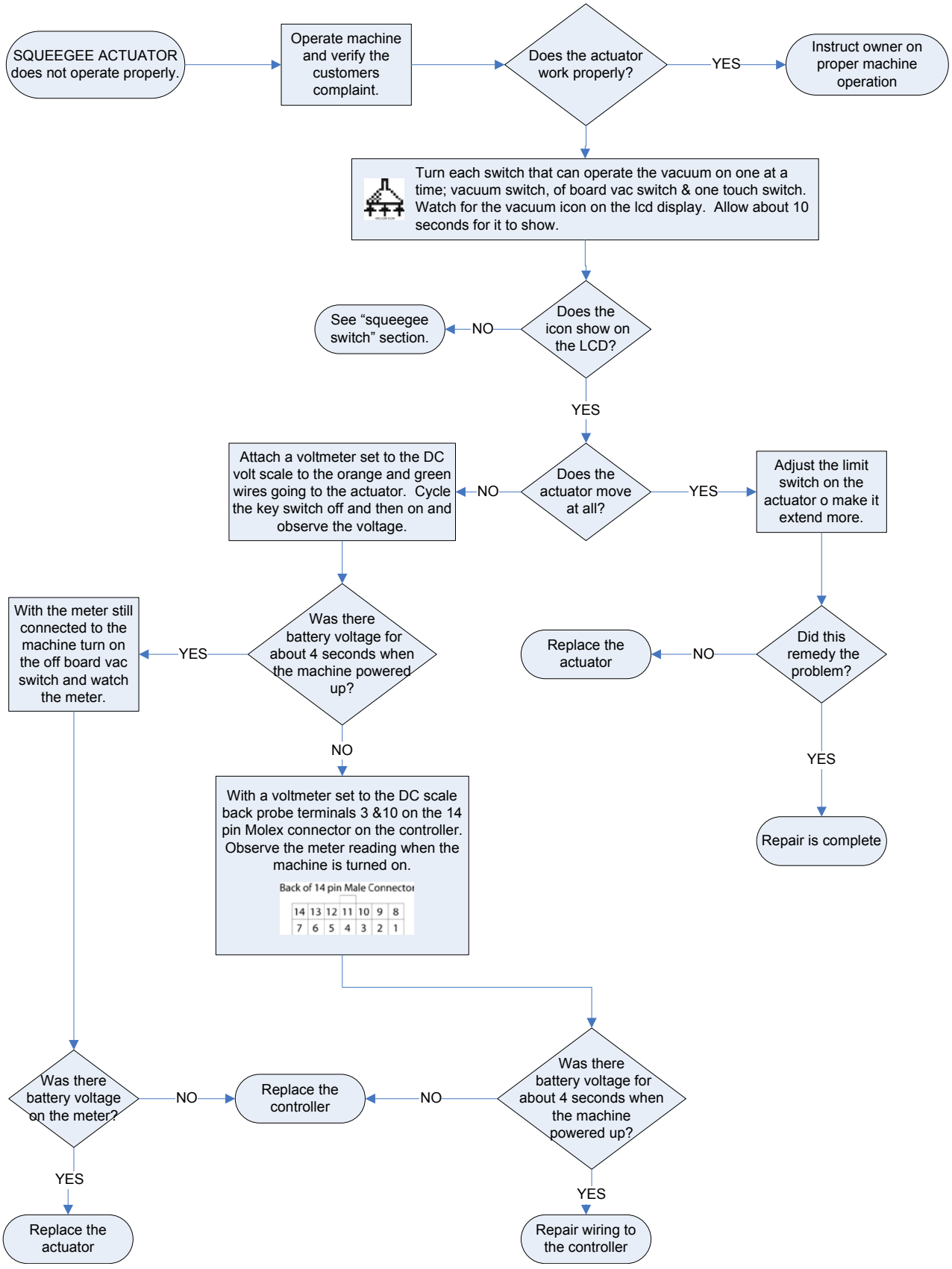
MAGNUM ONBOARD CHARGER DIAGNOSTIC FLOW CHART
1 of 2


FROM PAGE 1 -A-
Does the green light turn on when the charger is plugged into the wall?
YES
With a voltmeter set to the DC scale measure the voltage of the battery pack in the machine while the charger is turned on.
NO
With a voltmeter set to the DC scale measure the voltage of the battery pack in the machine.
Was the voltage at least 36 volts?
YES
Charger is ok
Is the voltage above 4.0 volts?
YES
NO
Replace the charger.

MAGNUM PAGE SWITCH DIAGNOSTIC FLOW CHART
1 of 1

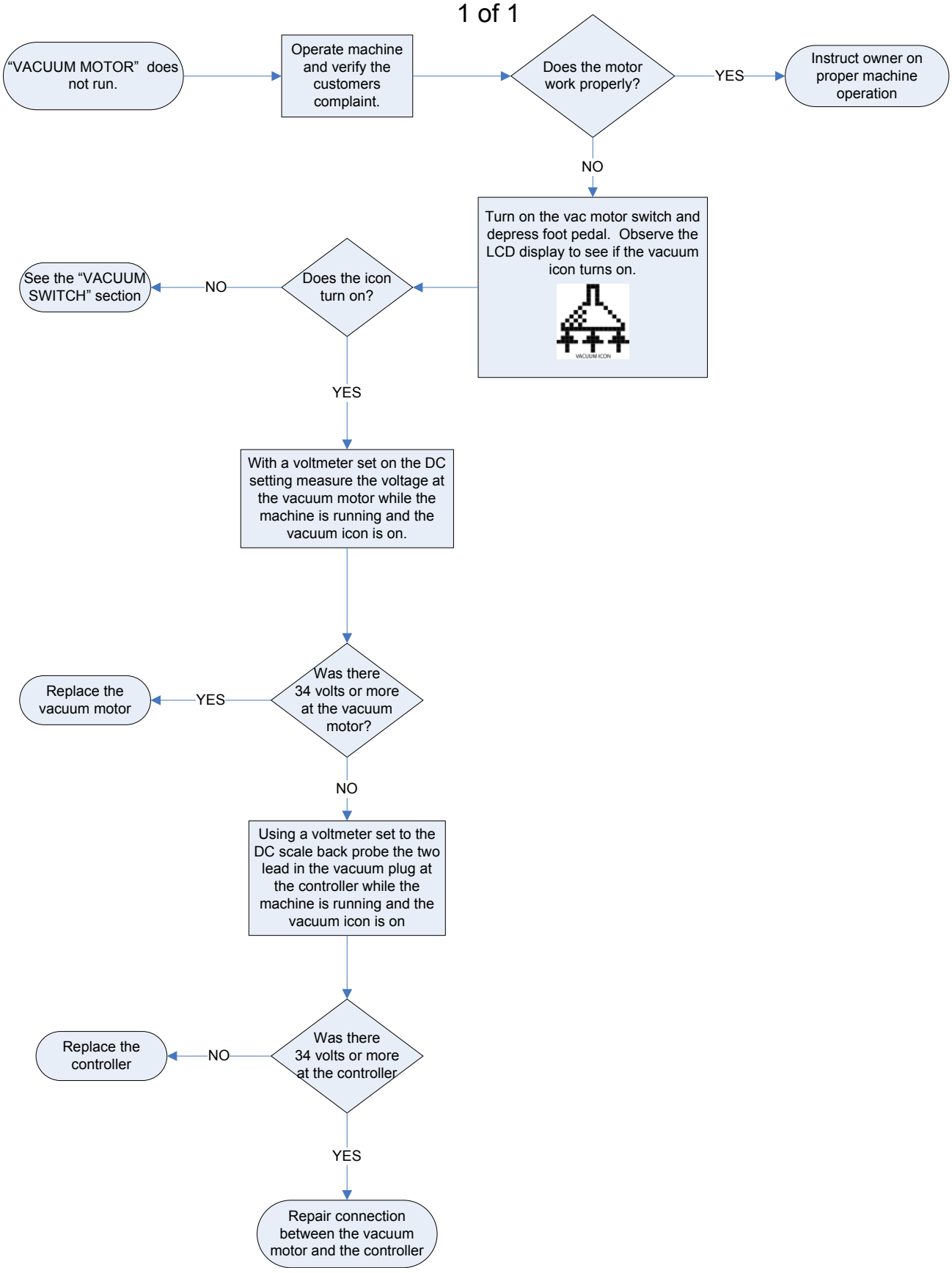

"PAGE" switch is in operative.
Operate machine and verify the customers complaint.
Does the switch work properly?
Instruct owner on proper machine operation
Unplug the 20 pin connector from the back of the LCD display
Using and Ohm meter measure across the 2 green wires (pins 12 and 16). You should have "OL" or infinite resistance when the switch is not depressed and you should have less than one ohm when you press in the switch.
Did you have the correct readings?
NO
Replace the page button and reset the machine
YES
Was the problem repaired?
NO
Replace the display with a know good display or a new one and retest the machine.
YES
Repair is complete
Did this repair the machine?
NO
Call the factory
YES
Replace the LCD display

MAGNUM SQUEEGEE ACTUATOR DIAGNOSTIC FLOW CHART
1 of 1

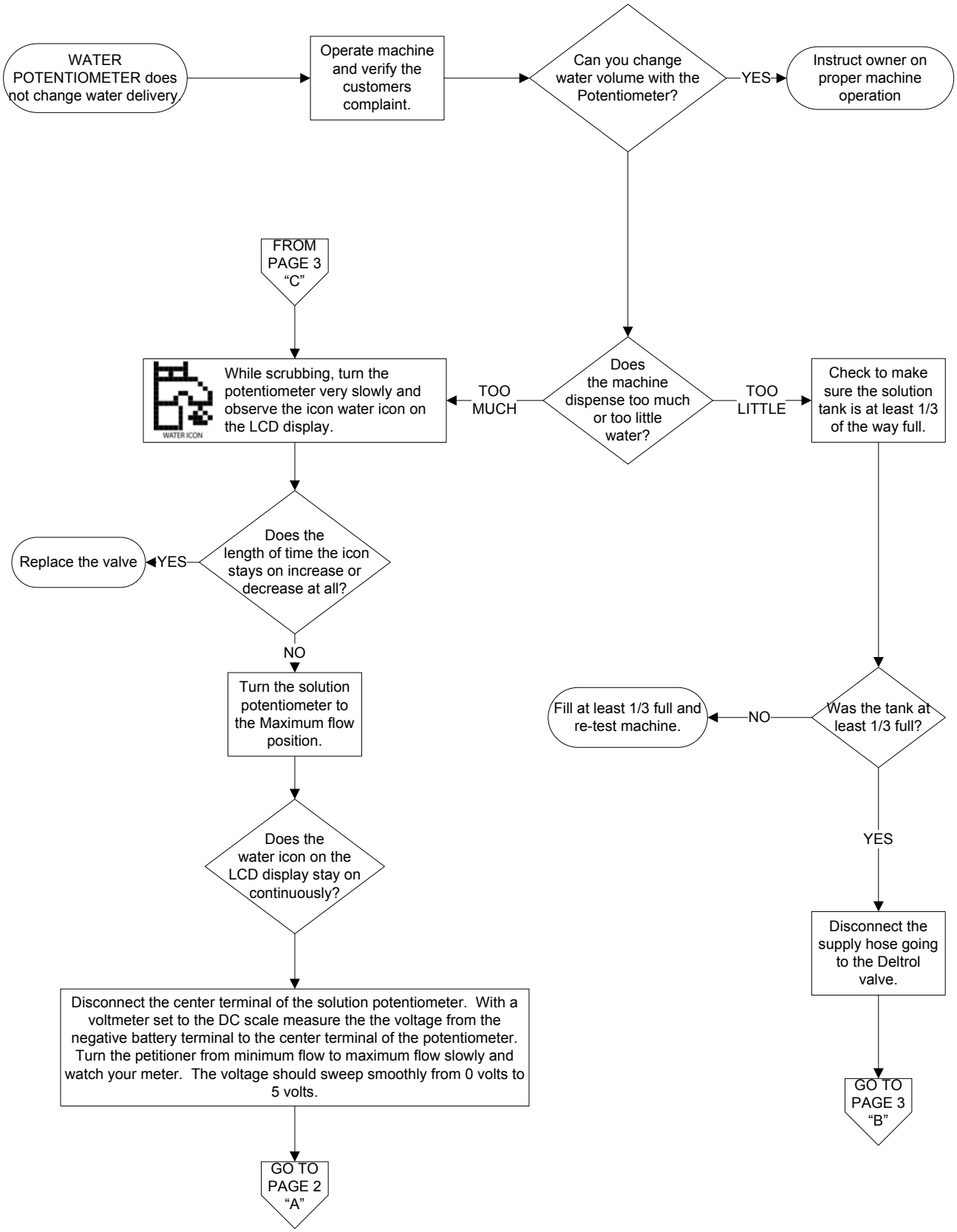

SQUEEGEE ACTUATOR does not operate properly.
Operate machine and verify the customers complaint.
Does the actuator work properly?
YES
Instruct owner on proper machine operation
Turn each switch that can operate the vacuum on one at a time; vacuum switch, of board vac switch & one touch switch. Watch for the vacuum icon on the lcd display. Allow about 10 seconds for it to show.
Does the icon show on the LCD?
NO
See "squeegee switch" section.
YES
Does the actuator move at all?
NO
Attach a voltmeter set to the DC volt scale to the orange and green wires going to the actuator. Cycle the key switch off and then on and observe the voltage.
YES
Adjust the limit switch on the actuator o make it extend more.
Was there battery voltage for about 4 seconds when the machine powered up?
YES
With the meter still connected to the machine turn on the off board vac switch and watch the meter.
NO
With a voltmeter set to the DC scale back probe terminals 3 &10 on the 14 pin Molex connector on the controller. Observe the meter reading when the machine is turned on.
Back of 14 pin Male Connector
14 13 12 11 10 9 8
7 6 5 4 3 2 1
Did this remedy the problem?
NO
Replace the actuator
YES
Repair is complete
Was there battery voltage on the meter?
NO
Replace the controller
YES
Replace the actuator
Was there battery voltage for about 4 seconds when the machine powered up?
NO
YES
Repair wiring to the controller

MAGNUM VACUUM MOTOR DIAGNOSTIC FLOW CHART

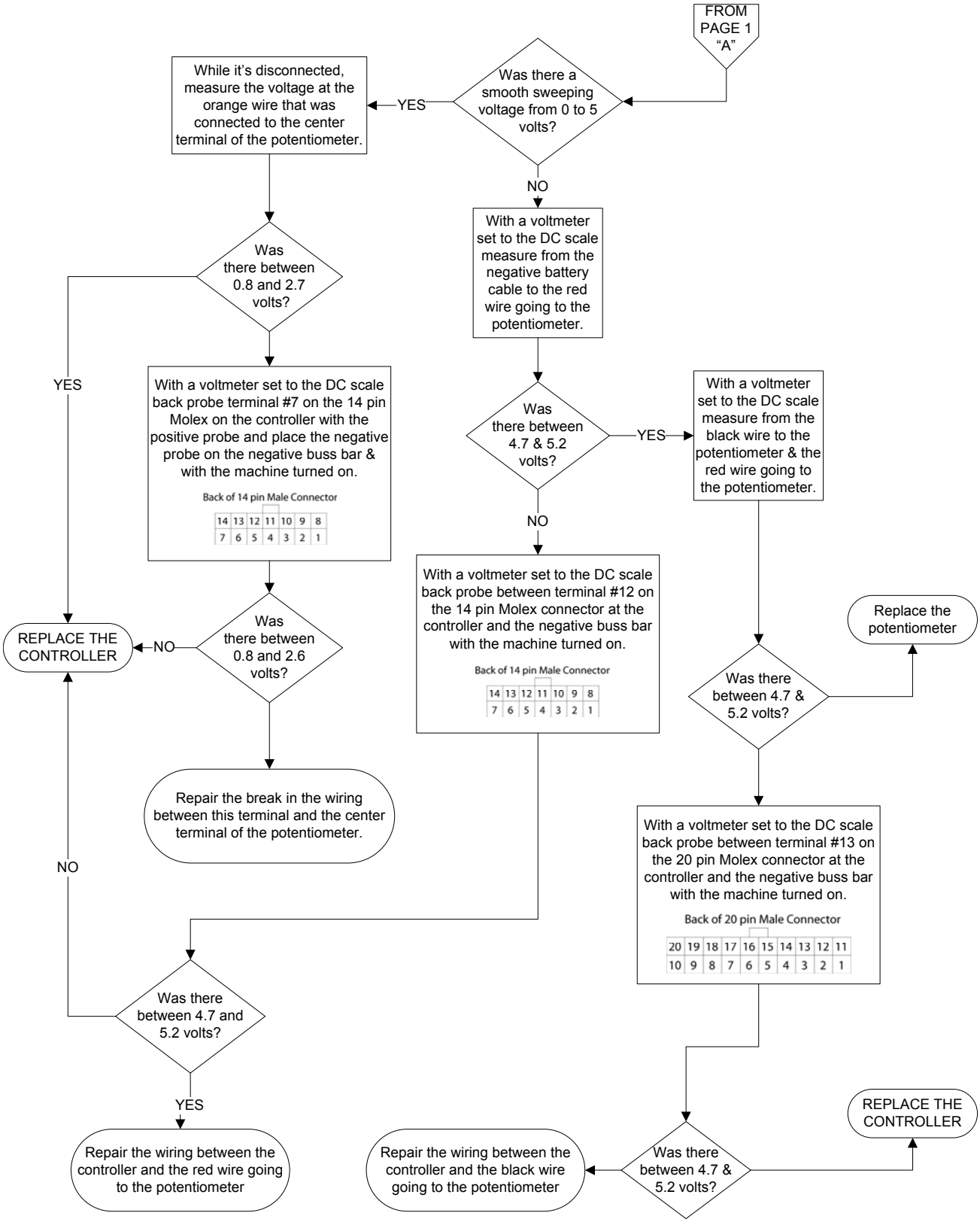
1 of 1


"VACUUM MOTOR" does not run.
Operate machine and verify the customers complaint.
Does the motor work properly?
YES
Instruct owner on proper machine operation
NO
Turn on the vac motor switch and depress foot pedal. Observe the LCD display to see if the vacuum icon turns on.
Does the icon turn on?
NO
See the "VACUUM SWITCH" section
YES
With a voltmeter set on the DC setting measure the voltage at the vacuum motor while the machine is running and the vacuum icon is on.
Was there 34 volts or more at the vacuum motor?
YES
Replace the vacuum motor
NO
Using a voltmeter set to the DC scale back probe the two lead in the vacuum plug at the controller while the machine is running and the vacuum icon is on
Was there 34 volts or more at the controller
NO
Replace the controller
YES
Repair connection between the vacuum motor and the controller

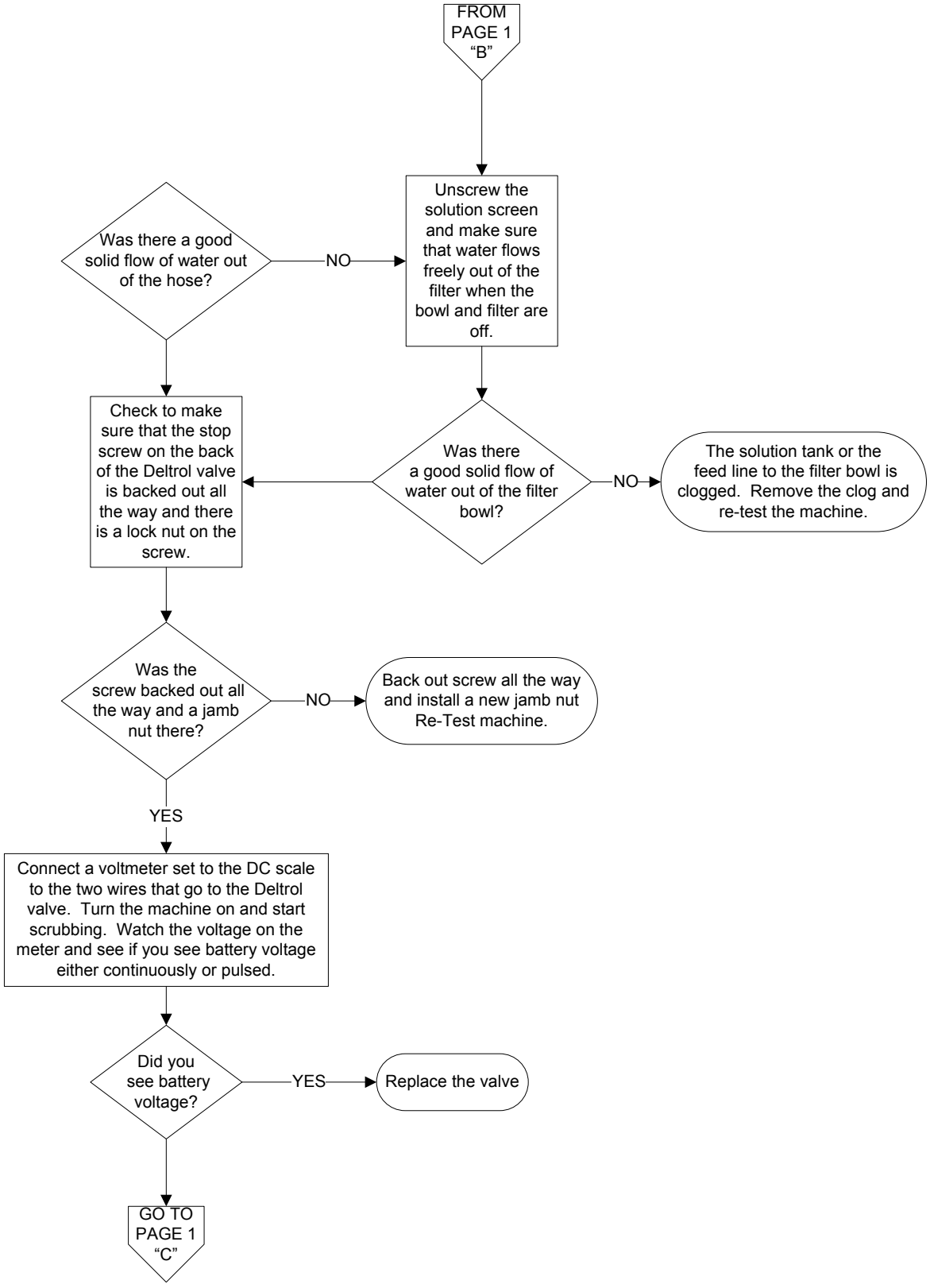
MAGNUM WATER POTENTIOMETER DIAGNOSTIC FLOW CHART
1 of 3


WATER POTENTIOMETER does not change water delivery.
Operate machine and verify the customers complaint.
Can you change water volume with the Potentiometer?
YES
Instruct owner on proper machine operation
FROM PAGE 3 "C"
Does the machine dispense too much or too little water?
TOO MUCH
While scrubbing, turn the potentiometer very slowly and observe the icon water icon on the LCD display.
WATER ICON
TOO LITTLE
Check to make sure the solution tank is at least 1/3 of the way full.
Does the length of time the icon stays on increase or decrease at all?
YES
Replace the valve
NO
Turn the solution potentiometer to the Maximum flow position.
Was the tank at least 1/3 full?
NO
Fill at least 1/3 full and re-test machine.
YES
Disconnect the supply hose going to the Deltrol valve.
GO TO PAGE 3 "B"
Does the water icon on the LCD display stay on continuously?
Disconnect the center terminal of the solution potentiometer. With a voltmeter set to the DC scale measure the the voltage from the negative battery terminal to the center terminal of the potentiometer. Turn the petitioner from minimum flow to maximum flow slowly and watch your meter. The voltage should sweep smoothly from 0 volts to 5 volts.
GO TO PAGE 2 "A"

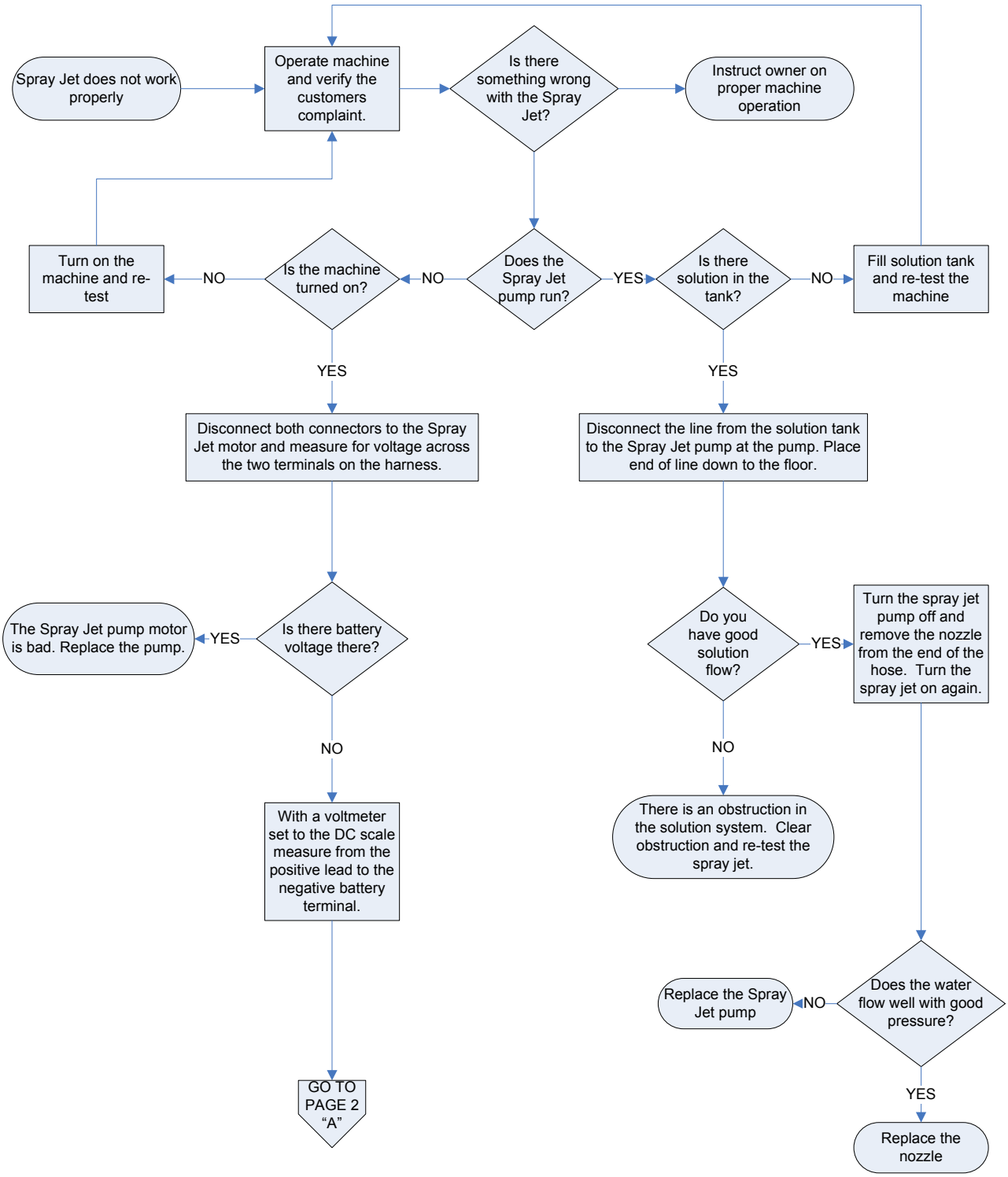
MAGNUM WATER POTENTIOMETER DIAGNOSTIC FLOW CHART
2 of 3


FROM PAGE 1 "A"
Was there a smooth sweeping voltage from 0 to 5 volts?
YES
While it's disconnected, measure the voltage at the orange wire that was connected to the center terminal of the potentiometer.
NO
With a voltmeter set to the DC scale measure from the negative battery cable to the red wire going to the potentiometer.
Was there between 0.8 and 2.7 volts?
YES
With a voltmeter set to the DC scale back probe terminal #7 on the 14 pin Molex on the controller with the positive probe and place the negative probe on the negative buss bar & with the machine turned on.
Back of 14 pin Male Connector
14 13 12 11 10 9 8
7 6 5 4 3 2 1
Was there between 4.7 & 5.2 volts?
YES
With a voltmeter set to the DC scale measure from the black wire to the potentiometer & the red wire going to the potentiometer.
NO
With a voltmeter set to the DC scale back probe between terminal #12 on the 14 pin Molex connector at the controller and the negative buss bar with the machine turned on.
Back of 14 pin Male Connector
14 13 12 11 10 9 8
7 6 5 4 3 2 1
REPLACE THE CONTROLLER
NO
Was there between 0.8 and 2.6 volts?
Repair the break in the wiring between this terminal and the center terminal of the potentiometer.
Replace the potentiometer
Was there between 4.7 & 5.2 volts?
With a voltmeter set to the DC scale back probe between terminal #13 on the 20 pin Molex connector at the controller and the negative buss bar with the machine turned on.
Back of 20 pin Male Connector
20 19 18 17 16 15 14 13 12 11
10 9 8 7 6 5 4 3 2 1
NO
Was there between 4.7 and 5.2 volts?
YES
Repair the wiring between the controller and the red wire going to the potentiometer
Repair the wiring between the controller and the black wire going to the potentiometer
Was there between 4.7 & 5.2 volts?
REPLACE THE CONTROLLER

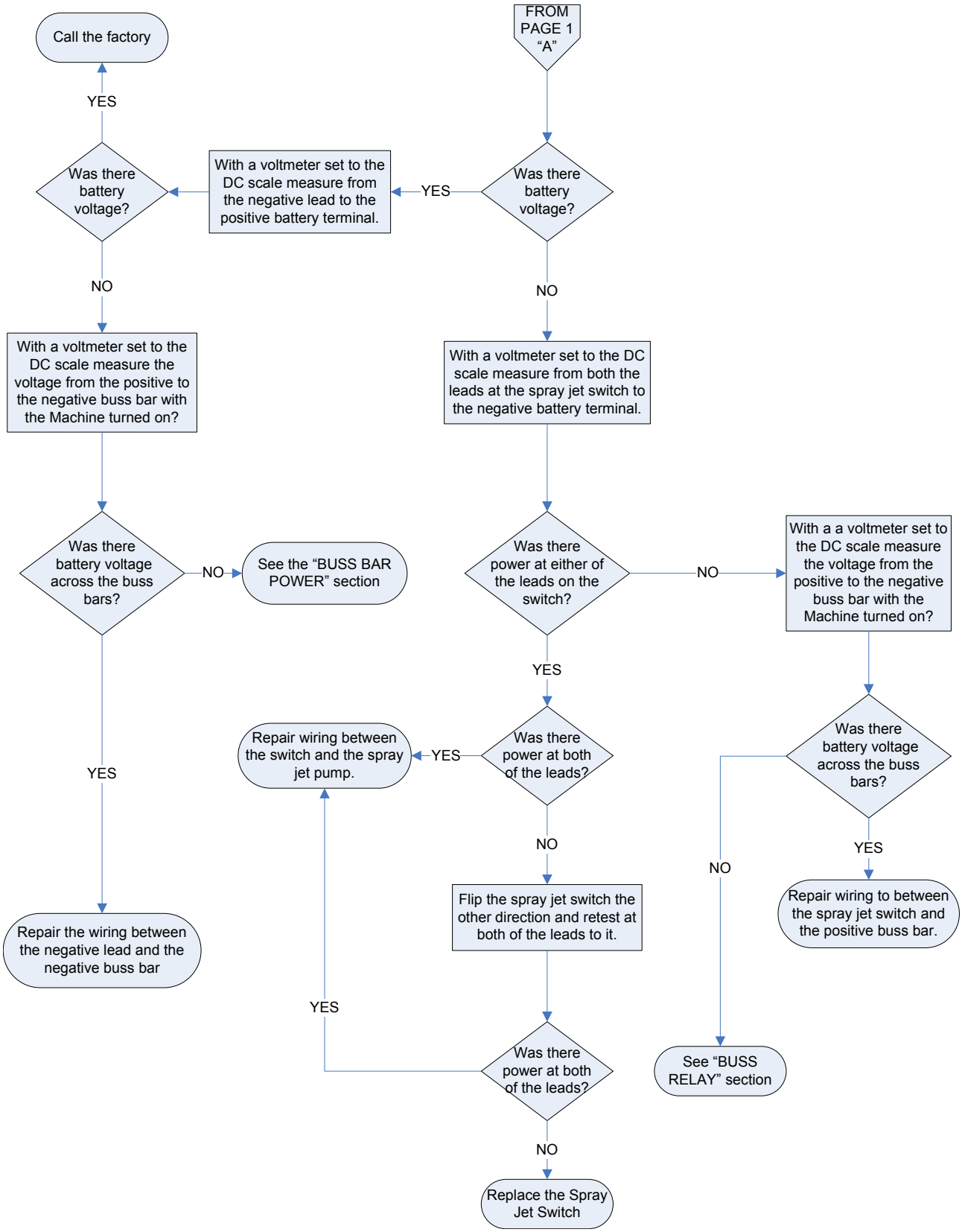
MAGNUM WATER POTENTIOMETER DIAGNOSTIC FLOW CHART
3 of 3


FROM PAGE 1 "B"
Unscrew the solution screen and make sure that water flows freely out of the filter when the bowl and filter are off.
Was there a good solid flow of water out of the hose?
NO
Check to make sure that the stop screw on the back of the Deltrol valve is backed out all the way and there is a lock nut on the screw.
Was there a good solid flow of water out of the filter bowl?
NO
The solution tank or the feed line to the filter bowl is clogged. Remove the clog and re-test the machine.
Was the screw backed out all the way and a jamb nut there?
NO
Back out screw all the way and install a new jamb nut Re-Test machine.
YES
Connect a voltmeter set to the DC scale to the two wires that go to the Deltrol valve. Turn the machine on and start scrubbing. Watch the voltage on the meter and see if you see battery voltage either continuously or pulsed.
Did you see battery voltage?
YES
Replace the valve
GO TO PAGE 1 "C"

MAGNUM SPRAY JET DIAGNOSTIC FLOW CHART
1 of 2


Spray Jet does not work properly
Operate machine and verify the customers complaint.
Is there something wrong with the Spray Jet?
Instruct owner on proper machine operation
Turn on the machine and re-test
NO
Is the machine turned on?
NO
Does the Spray Jet pump run?
YES
Is there solution in the tank?
NO
Fill solution tank and re-test the machine
YES
YES
Disconnect both connectors to the Spray Jet motor and measure for voltage across the two terminals on the harness.
Disconnect the line from the solution tank to the Spray Jet pump at the pump. Place end of line down to the floor.
The Spray Jet pump motor is bad. Replace the pump.
YES
Is there battery voltage there?
Do you have good solution flow?
YES
Turn the spray jet pump off and remove the nozzle from the end of the hose. Turn the spray jet on again.
NO
NO
With a voltmeter set to the DC scale measure from the positive lead to the negative battery terminal.
There is an obstruction in the solution system. Clear obstruction and re-test the spray jet.
GO TO PAGE 2 "A"
Replace the Spray Jet pump
NO
Does the water flow well with good pressure?
YES
Replace the nozzle

MAGNUM SPRAY JET DIAGNOSTIC FLOW CHART
2 of 2


FROM PAGE 1 "A"
Was there battery voltage?
YES
With a voltmeter set to the DC scale measure from the negative lead to the positive battery terminal.
Was there battery voltage?
YES
Call the factory
NO
With a voltmeter set to the DC scale measure the voltage from the positive to the negative buss bar with the Machine turned on?
NO
With a voltmeter set to the DC scale measure from both the leads at the spray jet switch to the negative battery terminal.
Was there battery voltage across the buss bars?
NO
See the "BUSS BAR POWER" section
Was there power at either of the leads on the switch?
NO
With a a voltmeter set to the DC scale measure the voltage from the positive to the negative buss bar with the Machine turned on?
YES
YES
Repair wiring between the switch and the spray jet pump.
YES
Was there power at both of the leads?
Was there battery voltage across the buss bars?
NO
YES
Repair the wiring between the negative lead and the negative buss bar
NO
Flip the spray jet switch the other direction and retest at both of the leads to it.
Repair wiring to between the spray jet switch and the positive buss bar.
NO
See "BUSS RELAY" section
YES
Was there power at both of the leads?
NO
Replace the Spray Jet Switch

2/23/2006

253-01 VACUUM MOTOR R&R

TIME REQUIRED: 30 MINUTES

NUMBER OF TECHS: 1 PERSON

REQUIRED PARTS

- 290-250 Vacuum motor
- Qty(1) 4'' wire tie
- Qty(2) 10-12 butt connectors

REQUIRED TOOLS

- 7\16 12 Point deep well socket
- 9\16 12 Point socket
- 6'' 3\8 extension
- Wire striper
- Wire cutter
- Wire crimper,10&12 awg insulated setting

COMPLETELY DRAIN RECOVERY TANK AND SOLTION TANK.

PLACE MACHINE ON LEVEL GROUND AND CHOCK WHEELS.

MAKE SURE MACHINE POWER SWITCH IS IN OFF POISTION.

TIPPING BACK TANK TO SERVICE VACUUM MOTOR.

1. Release latch on the right and left of machine. (see figure below)

2. Release the latch on the front of the jaws and open them. (see figure below)

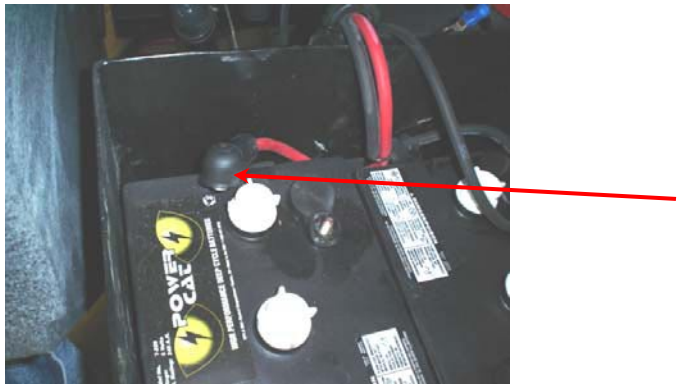
NEED PITCHER WHEN NEW PARTS ARE HERE

3. Carefully tip tank back. (see figure below)

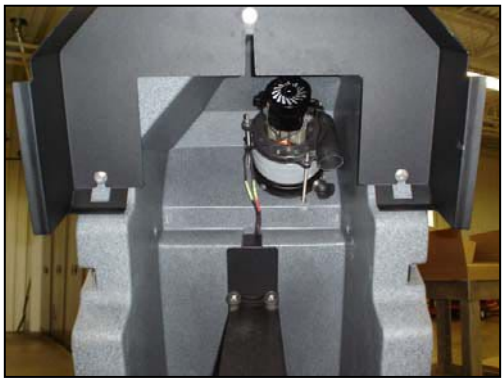
DISCONNECTING BATTERIES

1. Pull back the terminal cover, on the right batteries positive (+) terminal.
2. Use 9/16” socket to loosen and remove the 5\16 nut & Lock Washer.

3. Pull the red cable off and secure away from post .(See figure below)



VACUUM MOTOR IS LOCATED ON THE BOTTOM SIDE OF RECOVERY AND SOLTION TANK (see figure below)



REMOVING VACUUM MOTOR

1. Using a side cutters cut and remove the (QTY: 1) wire tie that holds the vacuum motor wires to the 6'' mounting stud. (see figure below)

1. Using a side cutters remove the yellow 10-12 AWG butt connectors. (see figure below)

2. Using 7\16”12 point deep well socket remove the (Qty: 3) 1\4 -20 nylock nuts that mount vacuum motor to tank.

3. Remove vacuum motor. (see figure below)

REINSTLLING NEW VACUUM MOTOR

1. Reinstall new vacuum motor on tank.(Do not over tighten the (Qty:3)1\4-20 nuts or you could damage the vacuum motor.

2. Locate red and black wires from machine and the two black wires from new vacuum motor strip 5\16”off each end. (See figure below)

3. Using a crimper with insolated 10 &12 setting connect the 10-12 butt connecters to the wires from the machine to the vacuum motor. (see figure below)

NOTE: VACUUM MOTOR IS NOT POLARITY SENSITIVE.

4. Using a (QTY: 1) 4’’ wire tie reconnect vacuum wires to the 4’’ stud

5. Reconnect batteries.

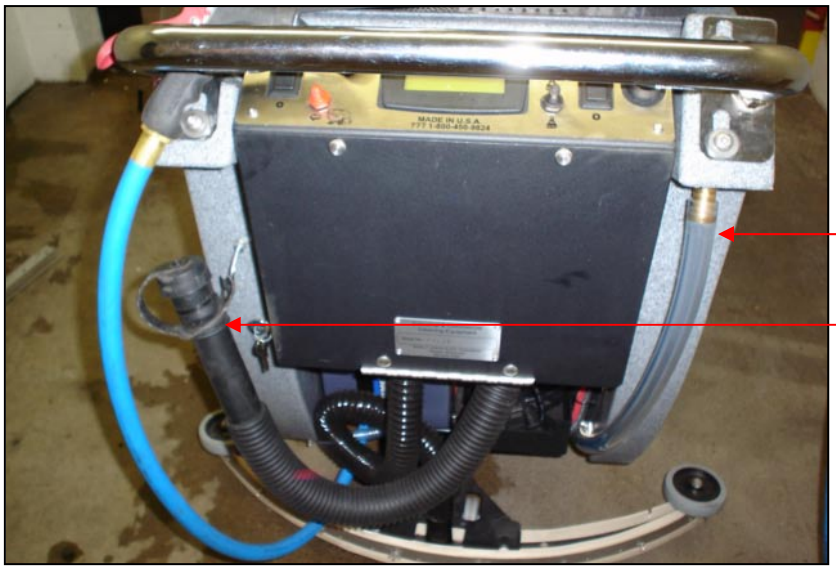
2/23/2006

253-02 DRAINING TANKS

NUMBER OF TECHS: 1 PERSON

COMPLETELY DRAINING RECOVERY AND SOLUTION TANKS.

1. Make sure machine is on level ground and by a floor drain.
2. Pull down on solution drain hose and set on floor drain to completely drain solution tank.
3. Lift recovery tank drain hose off J-hook. Unscrew cap and set on floor drain to empty tank.



2/23/2006 253-03 HANDLE BAR BUTTON SWITCH R&R

TIME REQUIRED: 30 MINUTES Per: SWITCH

NUMBER OF TECHS: 1 PERSON

REQUIRED PARTS

- Qty(2) 1/2'' long 16 awg shrink tubing
- Qty(2) 7-229 Push button switch

REQUIRED TOOLS

- 3'' long #2 Phillips short screw driver
- Wire striper
- Wire cutter
- Solder gun
- Flux core solder
- Heat gun
- 9\16 12- point box wrench

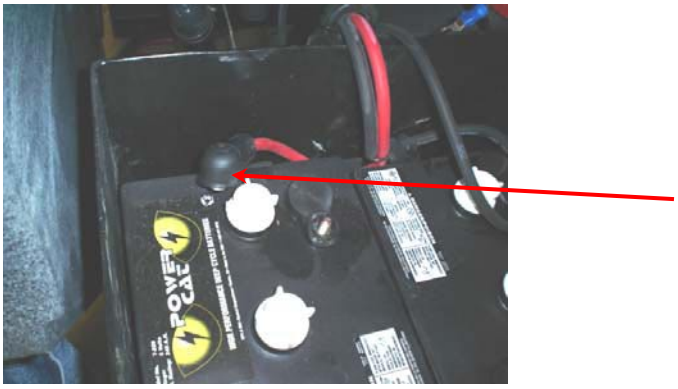
PLACE MACHINE ON LEVEL GROUND AND CHOCK WHEELS.

DISCONNECTING BATTERIES

1. Pull back the terminal cover, on the right batterie's positive (+) terminal.

2. Use 9/16" socket to loosen and remove the 5/16 nut & Lock Washer.

3. Pull the red cable off and secure away from post .(See figure below)



REMOVING OLD PUSH BUTTON SWITCH PLATE

1. Using a 3” #2 Phillips head screw driver remove the two 8\32x1\2” screws that hold the switch plate on handle bars.
2. Cut wires as close to switch as possible. (*See figure below)*

1. Remove old switch from switch plate and reinstall new switch onto switch plate.
3. Strip wires 1\4” and slide shrink tubing on to wires.
4. Solder wires on to switch then slide shrink tubing down on to soldered area and use a heat gun to shrink tubing.
5. Reinstall switch plate.
6. Reconnect batteries.

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253-04 DISCONNECTING BATTERIS

NUMBER OF TECHS: 1 PERSON

REQUIRED PARTS

- NONE

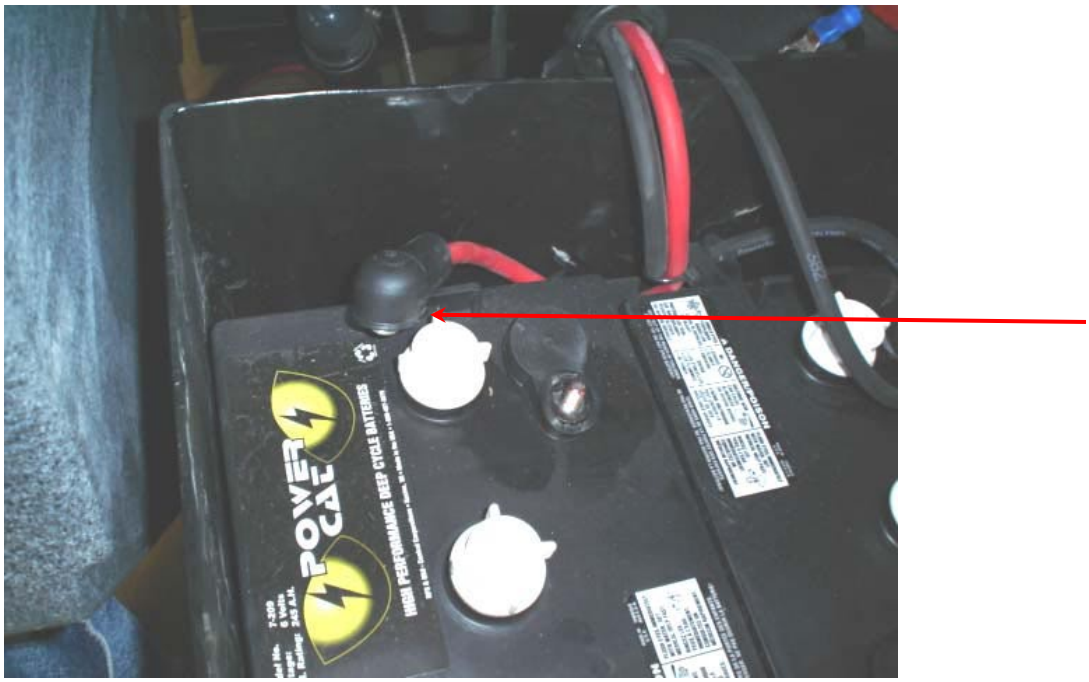
REQUIRED TOOLS

- 9\16 12- point box wrench

PLACE MACHINE ON LEVEL GROUND AND CHOCK WHEELS.

DISCONNECTING BATTERIES

1. Pull back the terminal cover, on the right batteries positive (+) terminal.
2. Use 9/16” socket to loosen and remove the 5\16 nut & Lock Washer.
3. Pull the red cable off and secure away from post .(See figure below)



253-05 TRANSAXLE R&R

TIME REQUIRED: 45 MINUTES

NUMBER OF TECHS: 1 PERSON

REQUIRED PARTS

- 32- 3000 Transaxle
- Qty(1) 8” wire tie
- Qty(2) 10-12 butt connectors

REQUIRED TOOLS

- 9\16” 12 Point socket
- 1\2” socket
- 6’’ 3\8 extension
- Wire striper
- Wire cutter
- Wire crimper,10&12 awg insulated setting
- (Qty:2) jack stands
- 3 Ton jack
- (QTY:2) 2’’X4’’X12’’ BOARDS

COMPLETELY DRAIN RECOVERY AND SOLUTION TANKS.
(SEE REPAIR INSTRUCTION # 253-02)

MAKE SURE MACHINE IS ON LEVEL GROUND.

DISCONNECT BATTERIES
(SEE REPAIR INSTRUCTION #253-04)

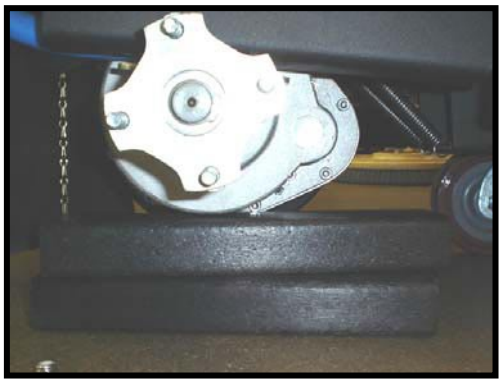
JACK UP MACHINE
(SEE REPAIR INSTRUCTION #253-06 FOR DISK MACHINE)

(SEE REPAIR INSTRUCTION #253-07 FOR CYLINDRICAL MACHINE)

REMOVING TRANSAXLE

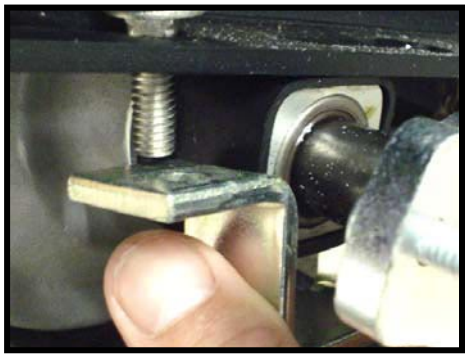
1. Using a 1/2” socket remove the (Qty 4) 5/16 nuts that hold each tire on axle.(Remove tiers)
2. Cut the wire tie that is around the wires harness located in the right rear tier compartment. Wires should drop down. Locate the two 10-12 butt connecters. Cut butt connecters off. The wires that lead from transaxle to wire harness.(See figures below)

3. Install the (QTY:2) 2’’x4’’x12’’ boards on top of each other under the transaxle motor housing.(see figure below)



4. Mark transaxle mounts and frame on both sides of machine before removing. (see figure below)

5. Using a 1\2” socket remove the (Qty 2) 5\16-18 nuts that hold the each (Qty2) axle mount to frame.
6. Remove transaxle mounts(See figure below)



7. Remove 2’’x4’’x12’’ boards while supporting axle.
8. Remove transaxle slowly. (See figure below)

REINSTALLING TRANSAXLE

1. Strip red and black transaxle wires 5\16”.
2. Strip red and black harness wires 5\16”.
3. Crimp butt connectors on to transaxle wires.
4. Carefully put new transaxle into position.
5. Carefully put 2’’x4’’x12’’ boards under new tranaxle.
6. Reinstall transaxle mounts (Making sure to use alignment marks) and install 5\16” nuts and lock washers and tighten.(See figure below)

7. Crimp butt connectors from transaxle wires back to harness and put 8”wire tie on the transaxle wires to the frame.
8. Reinstall the tires.
9. Remove jack stands.

2/23/2006

253-06 JACKING UP DISK MACHINE

NUMBER OF TECHS: 1 PERSON

REQUIRED TOOLS

- 3 Ton jack
- (QTY:2) Wheel chocks

COMPLETELY DRAIN RECOVERY AND SOLUTION TANKS.
(SEE REPAIR INSTRUCTION # 253-04)

MAKE SURE MACHINE IS ON LEVEL GROUND.

JACKING UP MACHINE

1. Make sure casters are in reverse position.
2. Put wheel chocks firmly behind caster wheels. (see figure below)

3. Open jaws and remove brushes.
4. Center jack under scrubdeck. (see figure below)

5. Raise jack.
6. Secure machine with jackstands.

2/23/2006 # 253-07 JACKING UP CYLINDRICAL MACHINE

NUMBER OF TECHS: 1 PERSON

REQUIRED TOOLS

- 3 Ton jack
- (QTY:2) Wheel chocks

COMPLETELY DRAIN RECOVERY AND SOLUTION TANKS.
(SEE REPAIR INSTRUCTOIN # 253-04)

MAKE SURE MACHINE IS ON LEVEL GROUND.

JACKING UP MACHINE

1. Make sure casters are in reverse position.
2. Put wheel chocks firmly behind caster wheels. (see figure below)

3. Center jack under scrubdeck. (see figure below)

4. Raise jack.
5. Secure with jackstands.

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253-09 CYLINDRICAL BELT R&R

TIME REQUIRED: 15 MINUTES

NUMBER OF TECHS: 1 PERSON

REQUIRED PARTS

- (QTY: 1) 353-8230 CYLINDRICAL BELT

REQUIRED TOOLS

- 9/16'' CROWS FOOT 3/8'' DRIVE
- 9/16'' OPEN END WRENCH

PLACE MACHINE ON LEVEL GROUND AND CHOCK WHEELS.

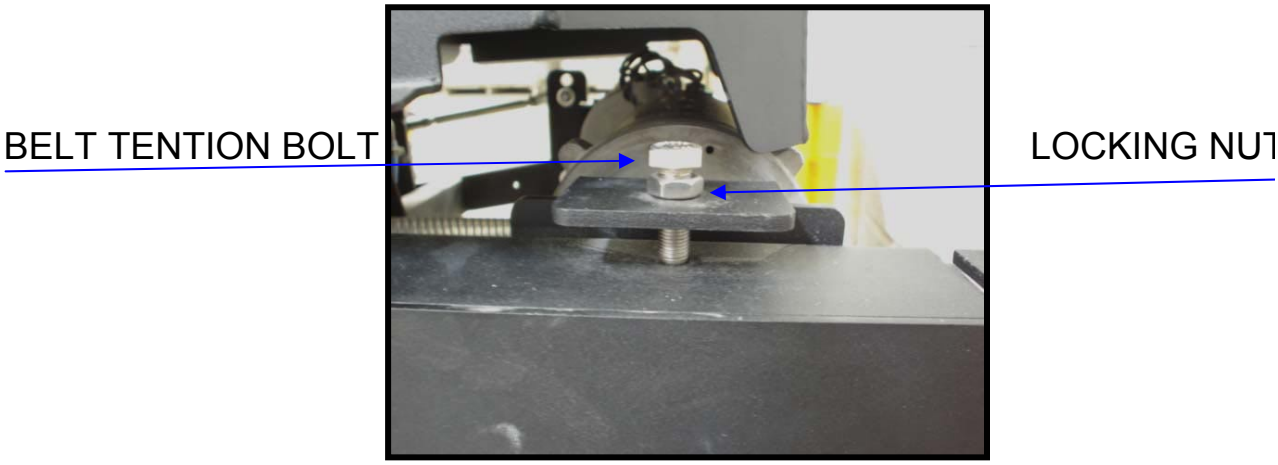
MAKE SURE MACHINE POWER SWITCH IS IN OFF POISTION.

DISCONNECT BATTERIES
(SEE REPAIR INSTRUCTION #253-04)

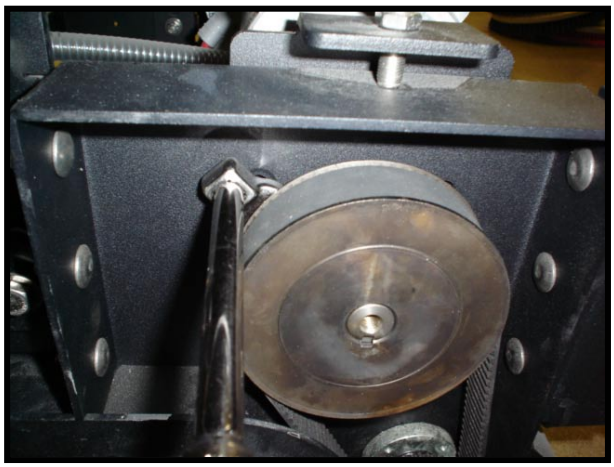
REMOVING CYLINDRICAL BELT

1. Remove cylindrical belt and brush accesses door.(see figure below)

2. Using a 9/16'' open end wrench loosen the (QTY: 1) 3/8-24 locking n and (QTY: 1) 3/8-24x1'' belt tension bolt. (see figure below)



3. Using a 9/16'' crows foot loosen the (QTY: 4) 3/8''-24x1'' bolts, that a located behind belt sprocket. (see figure below)



4. Remove belt by slipping it off lower sprocket then the top sprocket.(s figure below)

INSTALLING NEW CYLINDICAL BELT

1. Install belt on top sprocket then slip it onto bottom sprocket.
2. Using a 9/16'' open end wrench slowly tighten the 3/8''-24x1'' belt tension bolt. ***(NOTE: BELT TENTION SHOULD BE NO LESS THEN ¼'' DEFLECTOIN AND NO MORE THEN ½'' DEFLECTION.***
3. Using a 9/16'' open end wrench retighten the locking nut.
4. Using a 9/16'' CROWS FOOT retighten the (QTY: 4) 3/8-24X1'' bolts that are behind sprocket.
5. Reinstall cylindrical belt and brush accesses door.
6. Reconnect batteries

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SQUEEGEE SYSTEM 3-1
LIFT SYSTEM 3-1
SQUEEGEE TOOL 3-1

SAFETY MESSAGE

Your safety and the safety of others is very important and operating this unit safely is an important responsibility.

To help you make informed decisions about safety, we have provided operation procedures and other safety information in this manual. This information informs you of potential hazards that could hurt you or others.

It is not practical or possible to warn you of all the hazards associated with operating this unit. You must use your own good judgement.

This is intended for commercial use. It is designed to be used on hard floors only and in an indoor environment, with the recommended pads and brushes with approved cleaning solutions.

DO NOT OPERATE THE UNIT:

- UNLESS TRAINED AND AUTHORIZED.
- UNLESS OPERATOR MANUAL IS READ AND UNDERSTOOD.
- IF UNIT IS NOT IN PROPER OPERATING CONDITION.

WHEN OPERATING UNIT:

- WEAR PROPER PROTECTIVE EQUIPMENT.
- REMOVE LOOSE OBJECTS FROM THE FLOOR THAT MAY BE PROJECTED FROM THE REVOLVING BRUSHES.
- DO NOT OPERATE THE MACHINE WHERE FLAMMABLE LIQUIDS OR GASES ARE PRESENT.
- USE EXTREME CAUTION WHEN MANEUVERING.
- MAKE SURE ALL PERSONS ARE A SAFE DISTANCE FROM THE MACHINE WHILE IN OPERATION.

BEFORE LEAVING THE UNIT:

- MAKE SURE MACHINE IS TURNED OFF.
- PARK MACHINE ON A LEVEL SURFACE.
- DISCONNECT BATTERIES.

BEFORE SERVICING:

- STOP ON A LEVEL SURFACE AND SECURE MACHINE.
- DISCONNECT BATTERIES.

SAFETY PRECAUTIONS

- Hazardous voltage. Shock, Burns or electrocution can result. ALWAYS disconnect the batteries before servicing machine.
- Batteries emit hydrogen gases, explosion or fire can result. Keep sparks and open flame away.!
- Charge unit in a well ventilated area and keep battery compartment open when charging or explosion or fire could result.
- Battery acid can cause burns. Wear protective face-shield and gloves when servicing batteries.
- Do not store outdoors or pressure wash. Prevent from getting electrical components wet.
- The use of parts and solutions other than recommended by the manufacturer may cause property damage, bodily injury or death to yourself or others.
- Dress safely. Do not wear rings, watches or other jewelry while working on this machine. They can cause an electrical short which can cause serious burns, other injury or death.
- Do not work on this machine while wearing a tie, scarf, hat or any other loose or dangling neck wear or clothing. Loose clothing can tangle or catch on rotating parts causing serious injury or death.
- Do not use this machine as a ladder or a chair.
- Operate this machine only from the operators position.
- This machine was not designed to carry passengers or transport cargo.
- Do not operate this machine on steep ramps or uneven surfaces. When climbing a ramp always drive the machine forward straight up or down the ramp. Never drive across the incline.
- Do not back down or turn on ramps!
- Always use the charger provided by the manufacturer to charge the machine. It is an automatic charger specifically designed to charge at the appropriate rate. If you must use a different charger, disconnect the batteries from the machine as this will protect the on-board electronics.
- Understand the dynamic breaking system before you operate the machine on ramps or slopes.
- Do not park the machine on ramps or slopes
- Do not operate the machine if any parts have been removed or damaged.
- Do not remove, paint over, or destroy warning decals. If warning decals become damaged they must be replaced.
- Do not operate machine in an unsafe condition. If the machine is need of repair or is in anyway unsafe to operate, the matter should be reported immediately to the shift supervisor. Do not operate the machine until it is returned to proper operating condition.
- This machine must be operated only by a trained operator. As part of their training they must read the operators manual thoroughly. If extra copies are needed contact your local dealer.
- Always park machine on a level surface and turn the power off before leaving it unattended.
- Do not operate over electrical floor outlets. This may result in serious injury or death to the operator and others.
- Do not work under machine without it properly supported on suitable safety stands.
- Do not try and lift this machine unaided it is very heavy.
- Do not use handle bars or steering mechanism as a lifting point